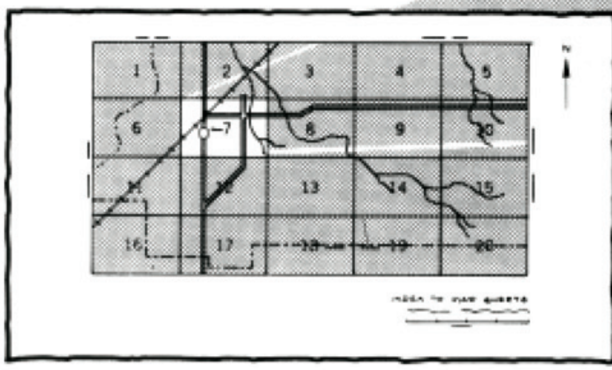
soil survey of

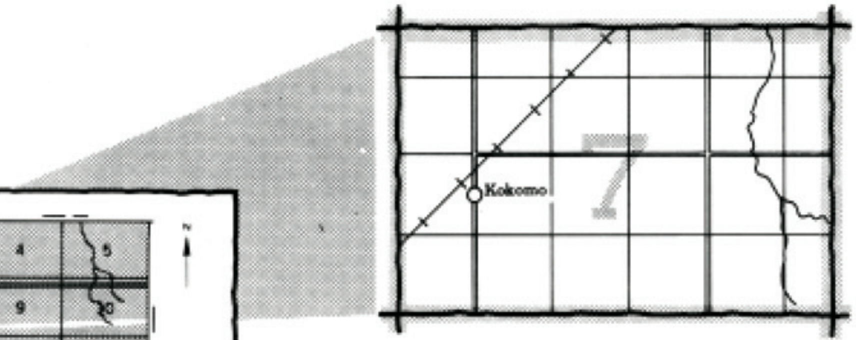
Barton County KANSAS

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Kansas Agricultural Experiment Station

HOW TO USE

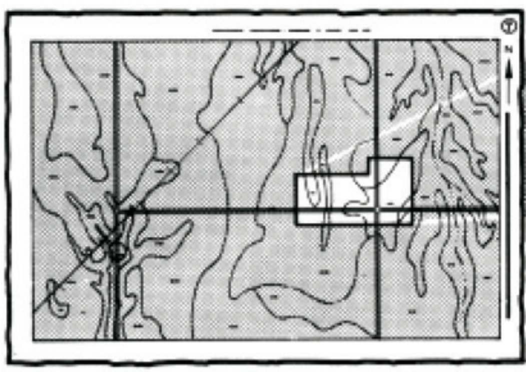
1. Locate your area of interest on the ''Index to Map Sheets''

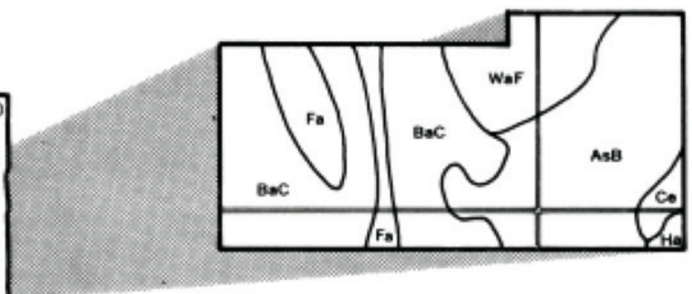




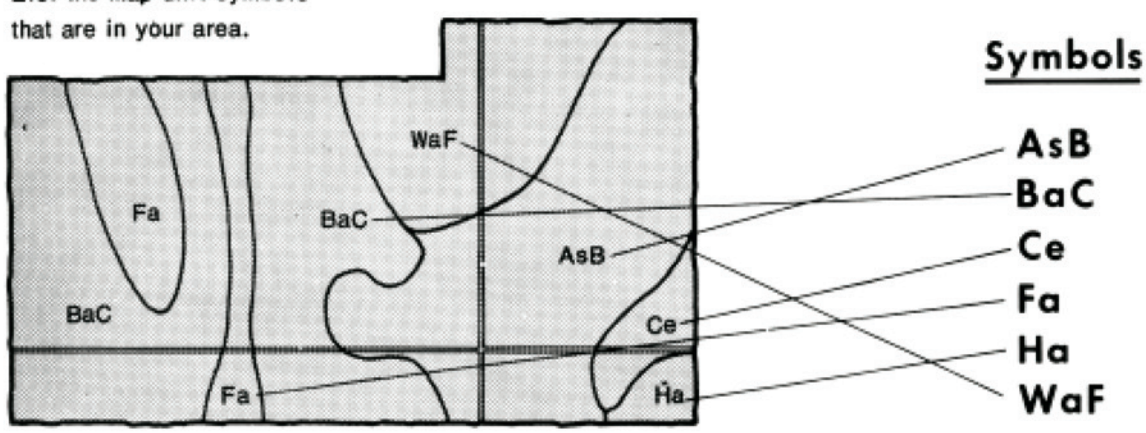
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



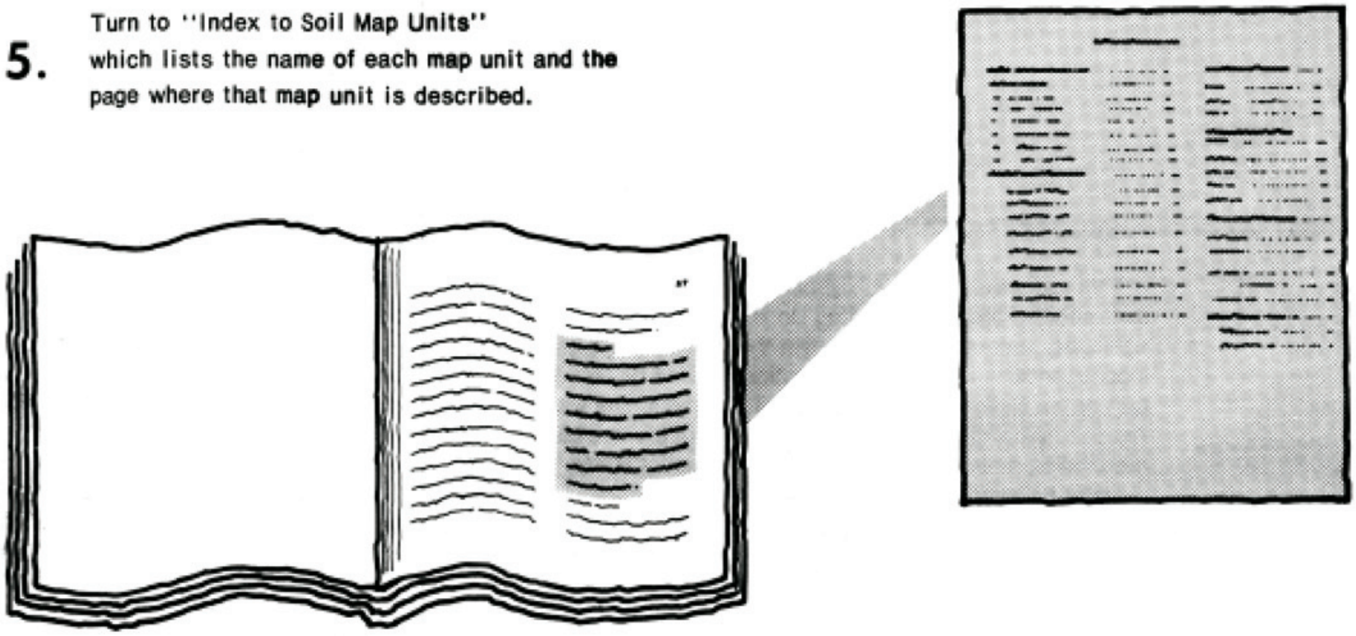


4. List the map unit symbols that are in your area.

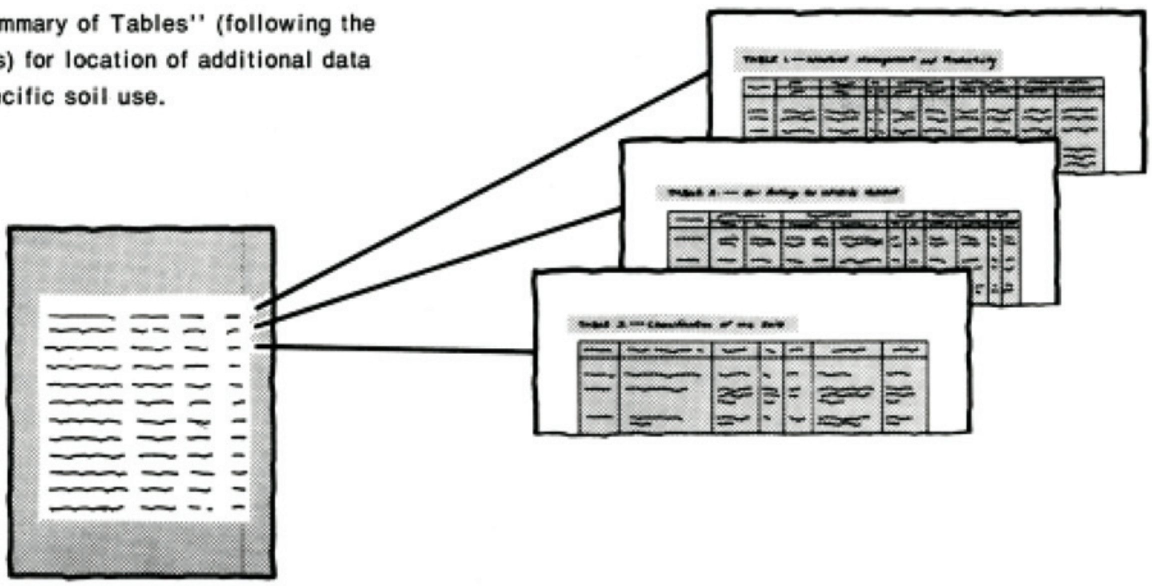


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Barton County Conservation District. Major fieldwork was performed in the period 1976 to 1979. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Grassed waterway in an area of Wakeen silt loam, 3 to 6 percent slopes. Grain sorghum is planted on the contour.

contents

soil series

Issued November 1981

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summary of tables

foreword

This soil survey contains information that can be used in land-planning programs in Barton County, Kansas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

John W. Tippie

John W. Tippie
State Conservationist
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soil survey of
Barton County, Kansas

By Darold A. Dodge, William A. Wehmueller, Bruce R. Hoffman,
and Thomas D. Grimwood, Soil Conservation Service

United States Department of Agriculture,
Soil Conservation Service,
in cooperation with Kansas Agricultural Experiment Station

general nature of the county

Barton County is in the north-central part of Kansas (fig.1). It has an area of about 575,360 acres, or 899 square miles. In 1978, it had a population of 31,720, and Great Bend, the county seat, had a population of 16,260. The county was organized in 1872.

Most of Barton County is in the Rolling Plains and Breaks land resource area. The area south of the Arkansas River, however, is in the Great Bend Sandy Plains land resource area, and the eastern part of the county is in the Central Loess Plains land resource area. The Rolling Plains and Breaks area is dissected by drainageways. Generally, the soils are deep, are nearly level to moderately sloping, and have a clayey or silty subsoil. The Great Bend Sandy Plains area lacks well defined drainageways. The soils are deep, are nearly level to rolling, and generally have a loamy or sandy subsoil. In the Central Loess Plains area, the soils are deep, are nearly level to moderately sloping, and have a clayey or silty subsoil. Cheyenne Bottoms, a broad depression near Hoisington, is a unique landform in the county.

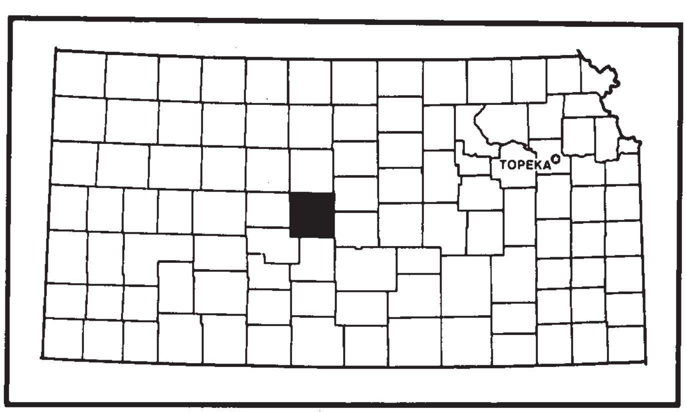

Figure 1.—Location of Barton County in Kansas.

The elevation in Barton County ranges from 1,710 to 2,080 feet above sea level. Most areas are drained by the Arkansas River, Wet Walnut Creek, and Cow Creek and their tributaries. These streams flow easterly or southeasterly.

The main enterprises in the county are farming and ranching. Wheat and grain sorghum are the main crops. Some manufacturing plants are located at Great Bend.

climate

Prepared by L. Dean Bark, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Barton County is typical continental, as can be expected of a location in the interior of a large land mass in the middle latitudes. Such climates are characterized by large daily and annual variations in temperature. Winter is cold because of frequent outbreaks of polar air. It lasts, however, only from December through February. Warm summer temperatures last for about 6 months every year. They provide a long growing season for the crops commonly in the county. Spring and fall generally are short.

Barton County generally is west of the flow of moisture-laden air from the Gulf of Mexico and east of the strong rain-shadow effects of the Rocky Mountains. As a result, the amount of annual precipitation is marginal for cropping year after year. It falls during

showers and thunderstorms that can be extremely heavy at times. The generally high winds in the county can result in significant soil loss and crop damage in the drier years. Conservation practices are necessary to conserve moisture and prevent excessive soil loss.

Severe windstorms and tornadoes can accompany the heavy thunderstorms, but they are infrequent and of local extent. Hail is a more severe weather hazard, but it causes less crop damage than the hailstorms in the counties west of Barton County.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Great Bend in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 33.5 degrees F, and the average daily minimum temperature is 22.0 degrees. The lowest temperature on record, which occurred at Great Bend on February 1, 1951, is -19 degrees. In summer the average temperature is 78.7 degrees, and the average daily maximum temperature is 91.4 degrees. The highest recorded temperature, which occurred at Great Bend on July 11, 12, and 13, 1954, is 111 degrees.

The total annual precipitation is 25.59 inches. Of this, 18.62 inches, or 73 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13.57 inches. The heaviest 1-day rainfall during the period of record was 5.65 inches at Claflin on June 1, 1965.

Average seasonal snowfall is 21.7 inches. The greatest snowfall, 50 inches, occurred during the winter of 1959-60. On an average of 19 days each year, at least 1 inch of snow is on the ground. The snow usually melts within a week.

The sun shines 77 percent of the time possible in summer and 65 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13.1 miles per hour, in spring.

natural resources

Soil is the most important natural resource in the county. It provides a growing medium for crops and for the grass grazed by livestock. Also, the clay from the Dakota Formation is used for making bricks. Other natural resources are ground water, oil and gas, salt, and sand and gravel.

Ground water underlies most of the county. Generally, the quantity and quality are adequate for irrigation only in the valleys of the Arkansas River and Wet Walnut Creek and in the areas south of the Arkansas River.

Oil and gas wells operate throughout the county. Salt is mined near Pawnee Rock. Sand and gravel are deposited along the Arkansas River.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

1. Harney-Crete association

Deep, nearly level and gently sloping, well drained and moderately well drained soils on uplands

This association is on broad ridgetops and side slopes that are dissected by drainageways and creeks. Slope ranges from 0 to 4 percent.

This association makes up about 62 percent of the county. It is about 60 percent Harney soils, 15 percent Crete soils, and 25 percent minor soils (fig. 2).

The well drained, gently sloping Harney soils formed in loess on ridgetops and side slopes. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, very firm silty clay; the next part is grayish brown, firm silty clay; and the lower part is light brownish gray, firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is light gray, calcareous silty clay loam.

The moderately well drained, nearly level Crete soils formed in loess on broad ridgetops. Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is dark grayish brown or brown, very firm silty clay; and the lower part is grayish brown, very firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is brown silty clay loam.

Minor in this association are Geary, Roxbury, Uly, and Wakeen soils. The well drained Geary soils are on side slopes. They are redder than the major soils. Roxbury soils are on flood plains along upland drainageways and creeks. The deep, well drained Uly soils and the moderately deep Wakeen soils are on the lower side slopes and on foot slopes.

This association is used mainly for cultivated crops, but some small areas are used for range. Winter wheat and grain sorghum are the main crops. Water erosion is a hazard in the gently sloping areas. Measures that control erosion, improve tilth and fertility, and conserve moisture are the main management needs.

2. Wakeen-Nibson association

Moderately deep and shallow, gently sloping to strongly sloping, well drained and somewhat excessively drained soils on uplands

This association is on narrow ridgetops, side slopes, and foot slopes that are dissected by drainageways and creeks. Rock commonly crops out. Slope ranges from 3 to 15 percent.

This association makes up about 6 percent of the county. It is about 60 percent Wakeen soils, 25 percent Nibson soils, and 15 percent minor soils (fig. 3).

The moderately deep, well drained, gently sloping to strongly sloping Wakeen soils formed in silty material weathered from chalky limestone and shale. They are on the upper side slopes and on foot slopes. Typically, the surface soil is dark grayish brown silt loam about 12 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is light brownish gray, and the lower part is very pale brown. Soft chalky shale or limestone is at a depth of about 36 inches.

The shallow, somewhat excessively drained, moderately sloping and strongly sloping Nibson soils formed in silty material weathered from soft chalky limestone or shale. They are on sharp slope breaks and the steeper, lower side slopes. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is very pale brown, friable silt loam about 6 inches thick. The substratum is very pale brown silt loam

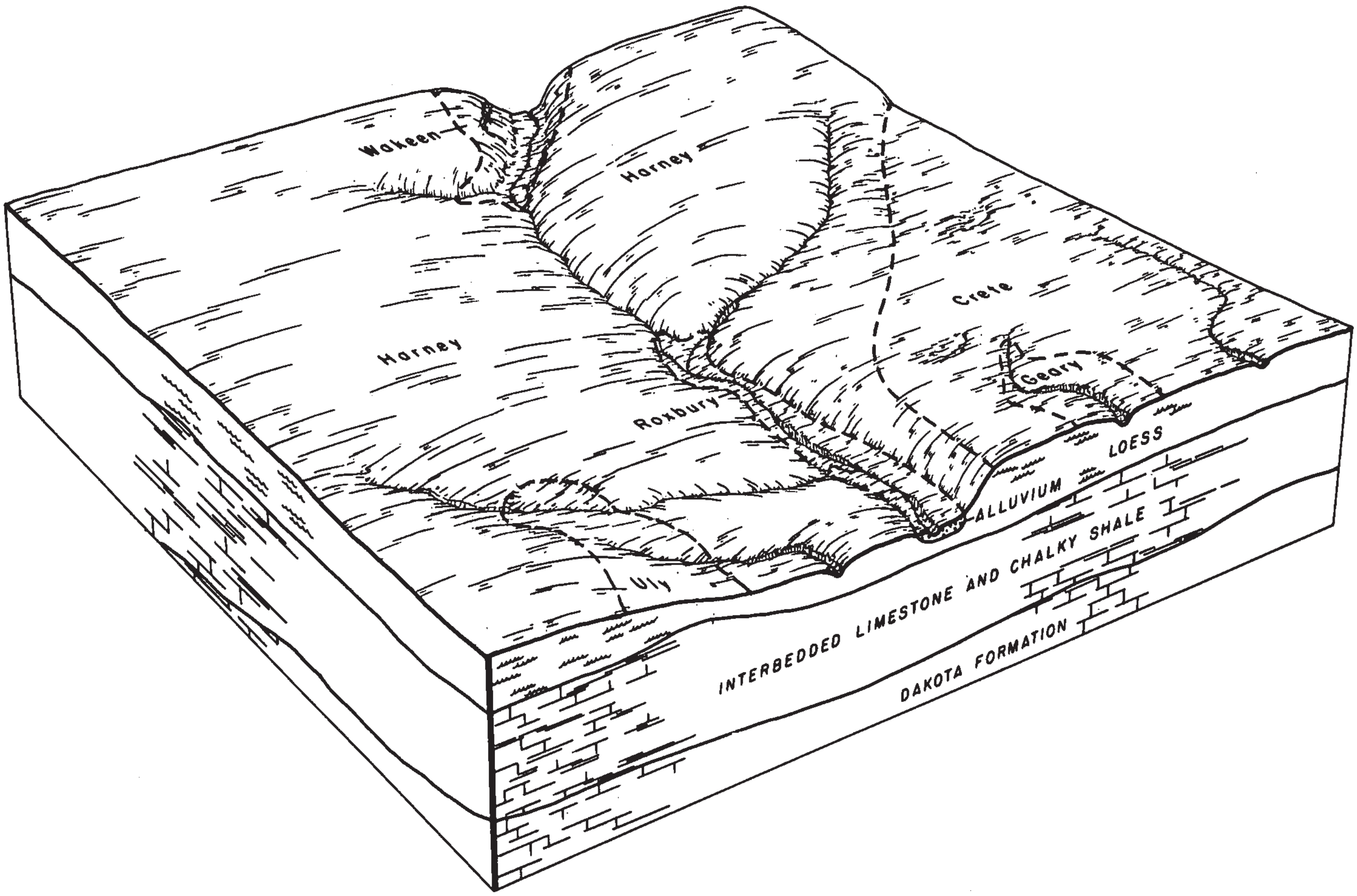

Figure 2.—Typical pattern of soils in the Harney-Crete association.

about 5 inches thick. Chalky shale and soft limestone are at a depth of about 19 inches.

Minor in this association are Harney, Roxbury, and Uly soils. The deep, well drained Harney soils are on ridgetops and the upper side slopes. Roxbury soils are on flood plains along upland drainageways and creeks. The deep, well drained Uly soils are on the lower side slopes.

About half of this association is used for cultivated crops. The rest is used mainly for range. Winter wheat and sorghum are the main crops. Water erosion is a hazard on the ridgetops, side slopes, and foot slopes. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs in the areas used as cropland. Proper stocking rates and measures that control erosion are the main management needs in the areas used as range.

3. New Cambria-Hord-Bridgeport association

Deep, nearly level, moderately well drained and well drained soils on terraces

This association is on terraces and flood plains along creeks. Slope ranges from 0 to 2 percent.

This association makes up about 6 percent of the county. It is about 55 percent New Cambria soils, 20 percent Hord soils, 20 percent Bridgeport soils, and 5 percent minor soils.

The moderately well drained New Cambria soils formed in calcareous, clayey alluvium. Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, firm silty clay about 7 inches thick. The subsoil is very firm silty clay about 17 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is grayish brown silty clay loam.

The well drained Hord soils formed in silty alluvium. Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is friable silt loam about 27 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is pale brown silt loam.

The well drained Bridgeport soils formed in silty alluvium. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is light brownish gray silt loam.

Minor in this association are the well drained, occasionally flooded Roxbury soils on flood plains along creeks and drainageways.

This association is used mainly for cultivated crops, but some small areas are used for range. Winter wheat and sorghum are the main dryland crops. Corn and sorghum are the main irrigated crops. Measures that improve tilth and fertility are the main management needs.

4. Platte-Waldeck association

Deep, nearly level, somewhat poorly drained soils on flood plains

This association is on flood plains along the Arkansas River. Slope is 0 to 1 percent.

This association makes up about 5 percent of the county. It is about 30 percent Platte soils, 30 percent Waldeck soils, and 40 percent minor soils (fig. 4).

The Platte soils formed in loamy and sandy alluvium. Typically, the surface layer is grayish brown fine sandy loam about 9 inches thick. The upper part of the substratum is pale brown loamy fine sand. The lower part to a depth of about 60 inches is pale brown sand.

The Waldeck soils formed in loamy alluvium. Typically, the surface layer is grayish brown fine sandy loam about 11 inches thick. The next 10 inches is pale brown, very friable fine sandy loam. The upper part of the substratum is very pale brown sandy loam. The lower part to a depth of about 60 inches is light yellowish brown fine sand.

Minor in this association are Canadian, Hord, Kaski, and Zenda soils. The deep, well drained Canadian, Hord, and Kaski soils are on terraces that are subject to rare flooding. The deep, somewhat poorly drained Zenda soils are on flood plains that are occasionally flooded.

About half of this association is used for cultivated crops. The rest is used mainly for range. Winter wheat and sorghum are the main crops. Measures that control soil blowing, conserve moisture, and improve fertility are

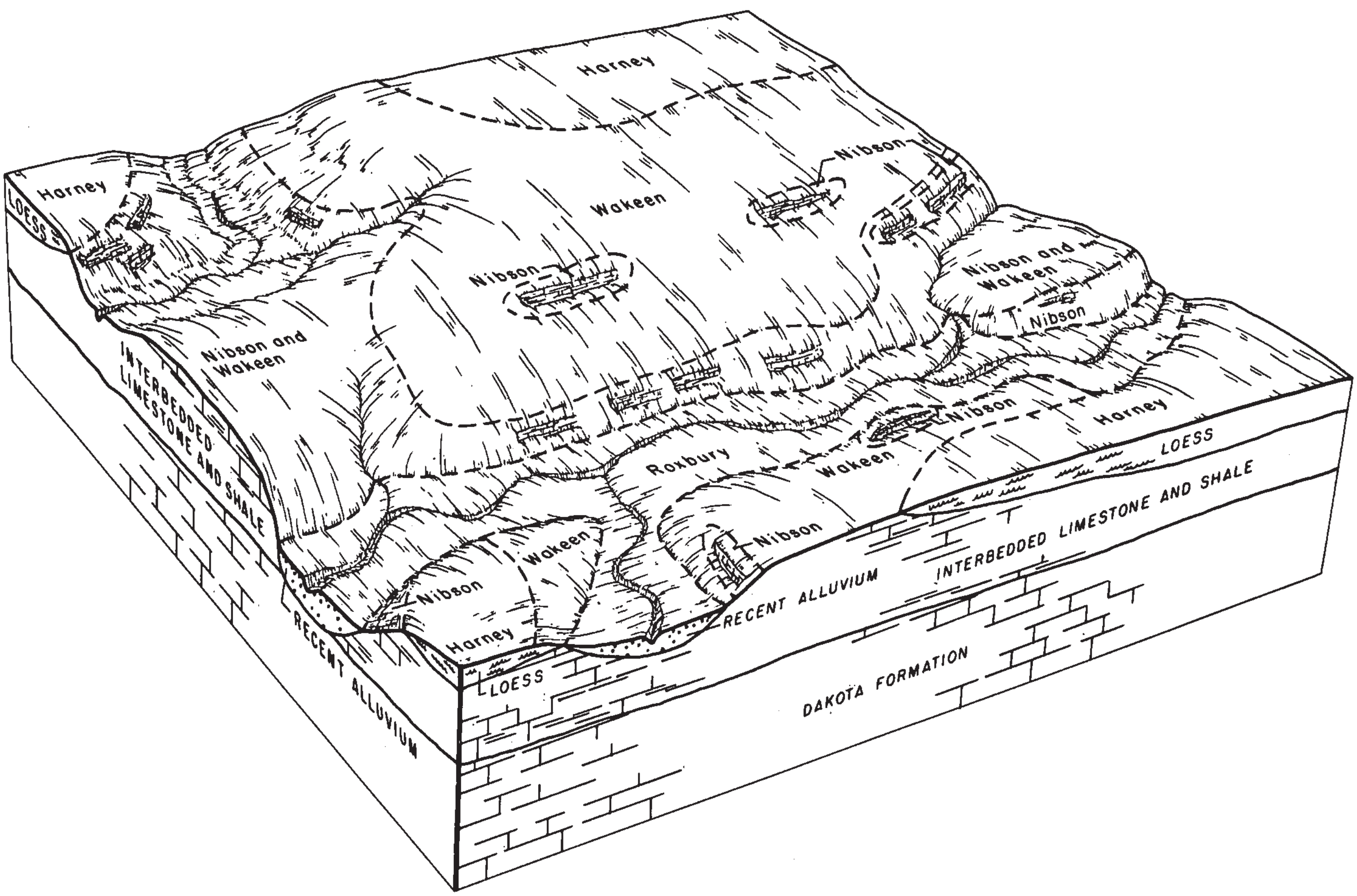

Figure 3.—Typical pattern of soils in the Wakeen-Nibson association.

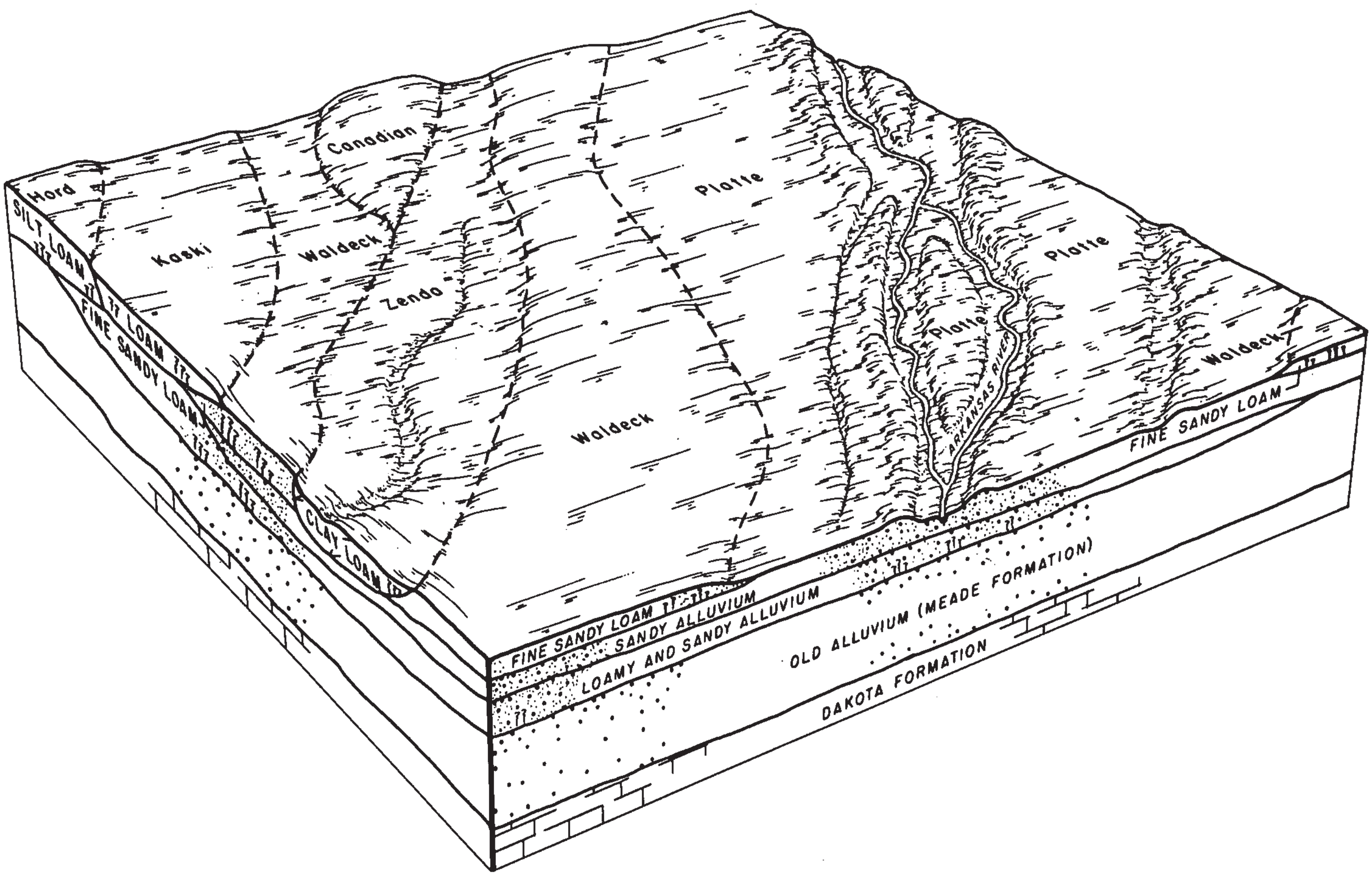

Figure 4.—Typical pattern of soils in the Platte-Waldeck association.

the main management needs in the areas used as cropland. Proper stocking rates and measures that control brush and trees are the main management needs in the areas used as range.

5. Drummond-Tabler association

Deep, nearly level, somewhat poorly drained and moderately well drained soils on the Cheyenne Bottoms and on old valley floors

This association is in low areas on old lakebeds and on terraces. The largest area is on the Cheyenne Bottoms. Slope is 0 to 1 percent.

This association makes up about 8 percent of the county. It is about 35 percent Drummond soils, 25 percent Tabler soils, 25 percent areas of water, and 15 percent minor soils (fig. 5).

The somewhat poorly drained Drummond soils formed in calcareous alluvium on old lakebeds and on terraces. Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is very firm clay about 22 inches thick. The upper part is grayish brown and has small accumulations of salts. The lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray silty clay loam.

The moderately well drained Tabler soils formed in calcareous, clayey old alluvium on the slightly higher parts of the landscape. Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is about 31 inches thick. The upper part is very dark grayish brown and dark grayish brown, very firm silty clay, and the lower part is brown, very firm silty clay loam. The substratum to a depth of about 60 inches is pale brown silty clay loam.

Minor in this association are Bridgeport, Hord, and New Cambria soils. The well drained Bridgeport and moderately well drained New Cambria soils are along drainageways. The well drained Hord soils are on high terraces near the uplands.

This association is used mainly for range. Some areas are used for wildlife habitat or cultivated crops. Proper stocking rates, timely deferment of grazing, rotation grazing, and a uniform distribution of grazing are needed to keep the range in good condition.

6. Naron-Farnum association

Deep, nearly level, well drained soils on uplands

This association is on low ridges and flats where drainageways are poorly defined. Slope ranges from 0 to 3 percent.

This association makes up about 5 percent of the county. It is about 60 percent Naron soils, 20 percent Farnum soils, and 20 percent minor soils (fig. 6).

The Naron soils formed in loamy eolian material on low ridges. Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is dark grayish brown, friable loam, and the lower part is brown, friable sandy clay loam. The substratum to a depth of about 60 inches is light brown fine sandy loam.

The Farnum soils formed in loamy old alluvium on flats. Typically, the surface layer is grayish brown loam or fine sandy loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is dark grayish brown, friable loam; the next part is brown, firm clay loam; and the lower part is pale brown, firm clay loam. The substratum to a depth of about 60 inches is brown, mottled fine sandy loam.

Minor in this association are Carwile, Pratt, and Tabler soils. The somewhat poorly drained Carwile soils are in low areas. The well drained, sandy Pratt soils are on the higher ridges. The moderately well drained Tabler soils are in shallow depressions.

This association is used mainly for cultivated crops, but some small areas are used for range. Winter wheat, grain sorghum, and alfalfa are the main crops. Soil blowing is a hazard. Measures that control soil blowing, conserve moisture, and improve tilth and fertility are the main management needs.

7. Pratt-Carwile association

Deep, nearly level to rolling, well drained and somewhat poorly drained soils on uplands and in upland depressions

This association is on ridges that have short side slopes and in slight depressions. Slope ranges from 0 to 12 percent.

This association makes up about 5 percent of the

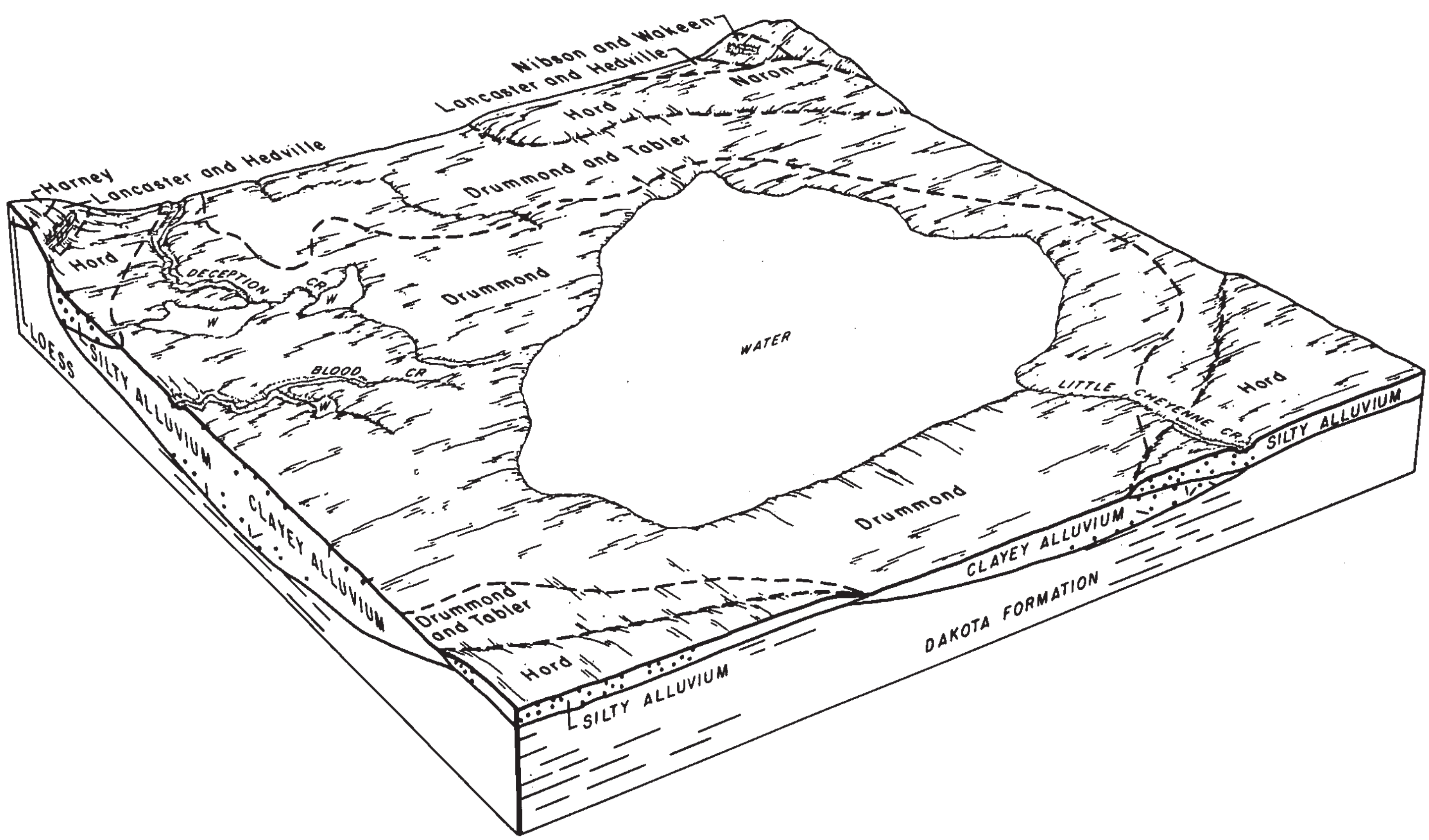

Figure 5.—Typical pattern of soils in the Drummond-Tabler association. The higher lying Harney, Hedville, Lancaster, Nibson, and Wakeen soils are not part of this association.

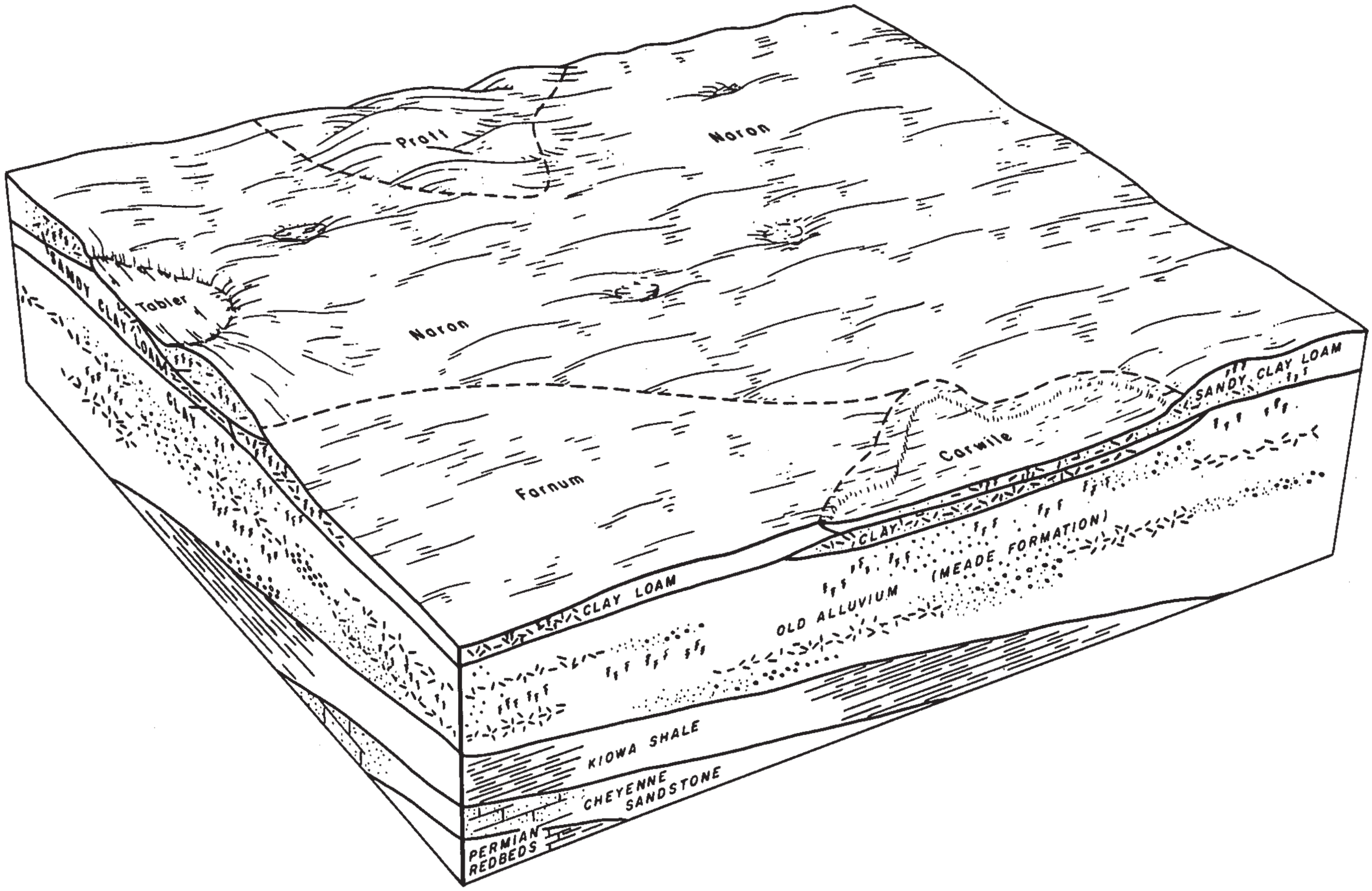

Figure 6.—Typical pattern of soils in the Naron-Farnum association.

county. It is about 65 percent Pratt soils, 15 percent Carwile soils, and 20 percent minor soils (fig. 7).

The well drained, undulating to rolling Pratt soils formed in sandy eolian sediments on ridges. Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is yellowish brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown loamy fine sand.

The somewhat poorly drained, nearly level Carwile soils formed in old alluvium in slight depressions. Typically, the surface layer is dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, friable sandy clay loam; the next part is grayish brown, mottled, very firm clay; and the lower part is gray, mottled, firm clay. The substratum to a depth of about 60 inches is light gray clay.

Minor in this association are the well drained Attica and Naron soils on the lower side slopes and the excessively drained Tivoli soils on the higher, steeper ridges.

This association is used mainly for cultivated crops, but some small areas are used for range. Winter wheat and sorghum are the main crops. Soil blowing is the major hazard, especially on the ridges. Measures that control soil blowing, conserve moisture, and improve tilth and fertility are the main management needs.

8. Pratt-Tivoli association

Deep, undulating to hilly, well drained and excessively drained soils on uplands

This association is on the tops of high ridges and on short side slopes. Slope ranges from 1 to 30 percent.

This association makes up 3 percent of the county. It is about 65 percent Pratt soils, 17 percent Tivoli soils, and 18 percent minor soils.

The well drained, undulating to rolling Pratt soils

formed in sandy eolian sediments on side slopes. Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is yellowish brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown loamy fine sand.

The excessively drained, rolling to hilly Tivoli soils formed in sandy eolian sediments on ridgetops and the steeper side slopes. Typically, the surface layer is grayish brown fine sand about 6 inches thick. The substratum to a depth of about 60 inches is light yellowish brown fine sand.

Minor in this association are the somewhat poorly drained Carwile and Dillwyn soils in low areas and the well drained Naron soils on the lower side slopes.

This association is used mainly for range, but some small areas are used for cultivated crops. Soil blowing is the major hazard. Measures that control soil blowing and conserve moisture are needed. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing are needed to keep the range in good condition.

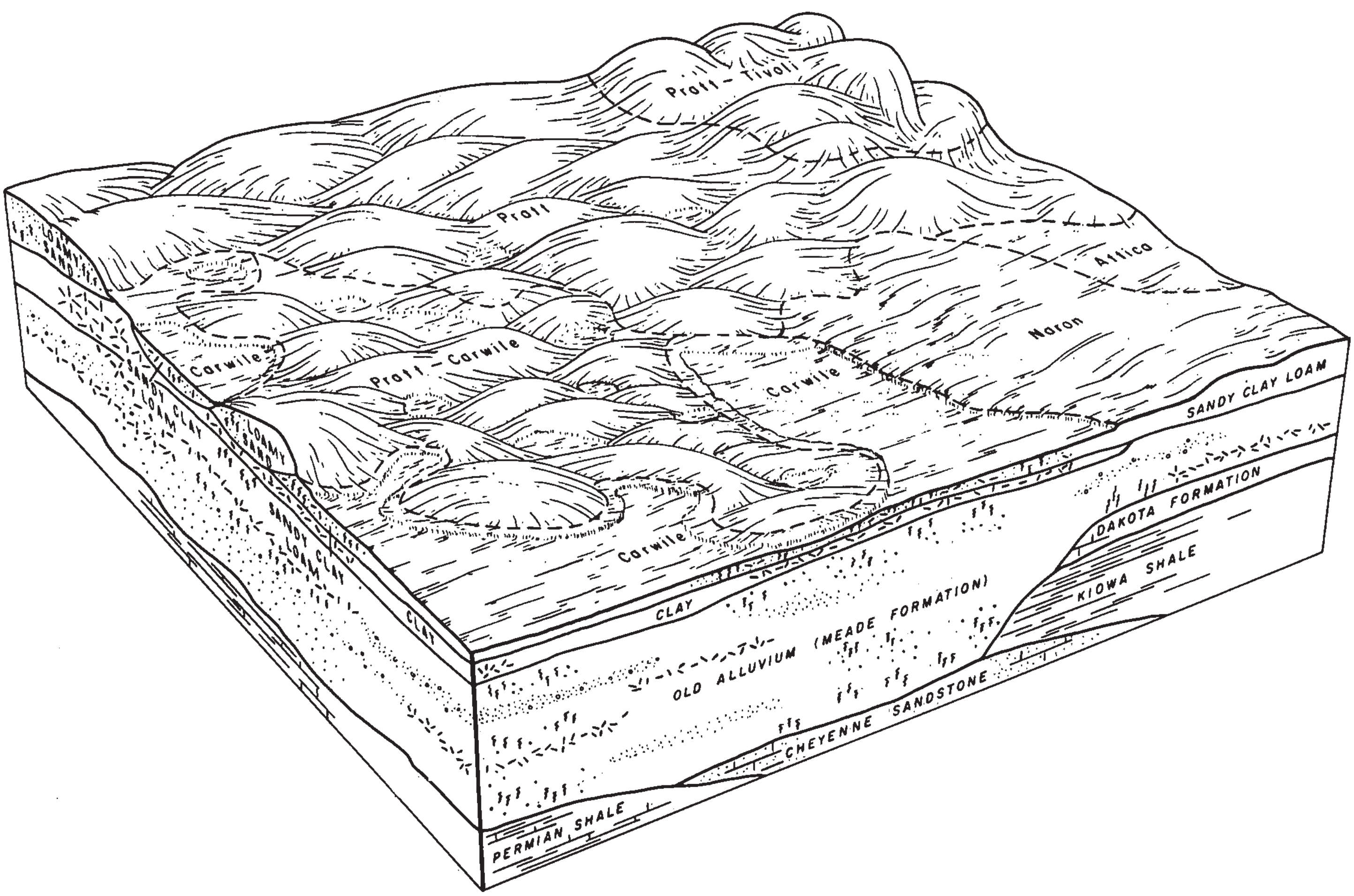

Figure 7.—Typical pattern of soils in the Pratt-Carwile association.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and identifies the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Geary silt loam, 1 to 3 percent slopes, is one of several phases in the Geary series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Nibson-Wakeen silt loams, 3 to 15 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations and capabilities for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

Aa—Attica loamy fine sand, 1 to 4 percent slopes. This deep, undulating, well drained soil is on uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is grayish brown loamy fine sand about 8 inches thick. The subsurface layer is dark grayish brown fine sandy loam about 4 inches thick. The subsoil is brown fine sandy loam about 24 inches thick. It is friable in the upper part and very friable in the lower part. The substratum to a depth of about 60 inches is brown loamy fine sand. In places the surface layer is fine sandy loam. In some areas the subsoil is more sandy, and in others it is more clayey.

Included with this soil in mapping are small areas of the somewhat poorly drained Carwile soils in depressions. These soils have a subsoil that is mottled and is dominantly clay. They make up 5 to 10 percent of the map unit.

Permeability is moderately rapid in the Attica soil, and available water capacity is moderate. Runoff is slow. Natural fertility is medium. The surface layer is very friable, and tilth is good. The surface layer is medium acid to neutral, and the subsoil is slightly acid or neutral.

Most areas are used for cultivated crops. Some small areas are used for range. This soil is suited to dryland and irrigated crops. Wheat and sorghum are the main dryland crops. Measures that control soil blowing and conserve moisture are the main management needs. Examples are minimizing tillage, wind stripcropping, and leaving crop residue on the surface.

Corn and sorghum are the main irrigated crops. The main management needs are the efficient use of irrigation water and measures that increase the organic matter content and improve fertility and tilth. Leaving crop residue on the surface improves tilth and helps to control soil blowing.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of less productive shorter grasses and of woody plants and weeds. Proper

stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil is suitable as a site for dwellings, septic tank absorption fields, and local roads and streets. Seepage is a severe limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability subclass is IIe.

Ba—Bridgeport silt loam. This deep, nearly level, well drained soil occurs as long, convex areas on terraces along the major streams in the county. Individual areas range from 50 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is light brownish gray silt loam. In some areas the thickness of the surface layer combined with that of the subsurface layer is more than 20 inches. In other areas, it is less than 7 inches.

Included with this soil in mapping are small areas of the moderately well drained New Cambria soils in slight depressions. These soils are more clayey than the Bridgeport soil. Also included are frequently flooded areas along narrow, meandering stream channels that have steep sides. Included areas make up 5 to 10 percent of the map unit.

Permeablity is moderate in the Bridgeport soil, and runoff is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used for range or tame pasture. This soil is well suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. The main management needs are measures that improve fertility and tilth. Minimizing tillage and leaving crop residue on the surface increase the organic matter content and improve fertility and tilth.

Alfalfa, corn, and grain sorghum are the main irrigated crops. The main management needs are the efficient use of irrigation water and measures that increase the organic matter content and improve fertility and tilth. Leaving crop residue on the surface increases the organic matter content and improves fertility and tilth. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of taller grasses and increases the extent of the less productive shorter grasses and of woody plants and weeds. Proper stocking rates, deferred grazing, a uniform distribution of grazing and a timely season of use help to keep the range in good condition. If the soil is used for tame pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The flooding is a severe hazard if this soil is used as a site for dwellings. It is a moderate hazard if the soil is used as a septic tank absorption field. Overcoming this hazard is difficult without major flood control measures. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. Seepage is a moderate limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability class is I.

Ca—Canadian fine sandy loam. This deep, nearly level, well drained soil occurs as convex areas on terraces along the Arkansas River. It is subject to rare flooding. Individual areas are irregular in shape and range from 30 to 600 acres in size.

Typically, the surface soil is dark grayish brown fine sandy loam about 14 inches thick. The subsoil is brown, friable sandy loam about 18 inches thick. The substratum to a depth of about 60 inches is pale brown sandy loam. In some areas coarse sand and fine gravel are within a depth of 40 inches. In other areas the substratum is calcareous.

Included with this soil in mapping are small areas of the somewhat poorly drained Waldeck soils on the lower flood plains. These soils make up 5 to 10 percent of the map unit.

Permeability is moderately rapid in the Canadian soil, and available water capacity is moderate. Runoff is slow. Natural fertility is medium. The surface layer is very friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used for range or tame pasture. This soil is well suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Measures that control soil blowing and conserve moisture are the main management needs. Stripcropping, minimizing tillage, and leaving crop residue on the surface help to control soil blowing, conserve moisture, and improve tilth and fertility.

Alfalfa, corn, and grain sorghum are the main irrigated crops. The main management needs are the efficient use of irrigation water and measures that increase the organic matter content and improve fertility and tilth. Leaving crop residue on the surface improves tilth and helps to control soil blowing. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of woody plants and weeds. Proper stocking rates, deferred grazing, a uniform distribution of grazing, and a timely season of use help to keep the range in good condition. If the soil is used for tame pasture, applications of fertilizer are needed to increase

forage production. They are especially needed if the pasture is irrigated.

The flooding is a severe hazard if this soil is used as a site for dwellings. It is a moderate hazard if the soil is used as a septic tank absorption field or a site for local roads and streets. Overcoming this hazard is difficult without major flood control measures. Seepage is a severe limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIe.

Cb—Carwile fine sandy loam. This deep, nearly level, somewhat poorly drained soil is on broad, slightly depressional uplands. It is occasionally ponded. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, friable sandy clay loam; the next part is grayish brown, mottled, very firm clay; and the lower part is gray, mottled, firm clay. The substratum to a depth of about 60 inches is light gray clay. In some areas the subsoil is less clayey. In other areas, the soil is moderately well drained and the subsoil is mottled only in the lower part.

Included with this soil in mapping are small areas of the well drained Farnum, Naron, and Pratt soils on the higher side slopes and ridges. These soils make up 10 to 15 percent of the map unit. Their subsoil is less clayey than that of the Carwile soil.

Permeability is slow in the Carwile soil, and runoff is slow to ponded. A seasonal high water table is near or above the surface. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used for range. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Measures that drain the low areas during periods of high rainfall and control soil blowing during periods of low rainfall are the main management needs. Drainage ditches help to remove excess surface water. Stripcropping, minimizing tillage, and leaving crop residue on the surface conserve moisture and help to control soil blowing.

Corn and grain sorghum are the main irrigated crops. The main management needs are the efficient use of irrigation water and measures that drain the low areas, increase the organic matter content, and improve fertility and tilth. A surface drainage system reduces the wetness and helps to control the ponding. Leaving crop residue on the surface improves tilth, increases the organic matter content, and helps to control soil blowing. Land leveling, a drainage system, and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, a uniform distribution of grazing, and a timely season of use help to keep the range in good condition. If the soil is used for tame pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The shrink-swell potential and the ponding are severe limitations if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings, installing foundation drains, and backfilling foundations with a layer of suitable coarse material help to prevent the damage caused by shrinking and swelling. A surface drainage system helps to control the ponding. Low strength, the shrink-swell potential, and the ponding are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to prevent the damage resulting from low strength or from shrinking and swelling. A surface drainage system and filling and shaping low areas help to prevent the damage caused by ponding.

This soil generally is unsuitable as a septic tank absorption field because the slow permeability and the ponding are severe limitations. It is suitable as a site for sewage lagoons only if the ponding is controlled.

The capability subclass is IIw.

Cr—Crete silt loam. This deep, nearly level, moderately well drained soil is on broad upland flats and ridgetops. Individual areas are irregular in shape and range from 100 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is dark grayish brown and brown, very firm silty clay; and the lower part is grayish brown, very firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is brown silty clay loam. In some areas the subsoil is less clayey. In other areas the soil is dark to a depth of less than 20 inches and is less than 25 inches deep to lime.

Included with this soil in mapping are small areas of Farnum and Tabler soils. The well drained Farnum soils are on the slightly higher ridges. Their subsoil is less clayey than that of the Crete soil. The very slowly permeable Tabler soils are in slight depressions. Included soils make up 5 to 10 percent of the map unit.

Permeability is slow in the Crete soil. Runoff also is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is high in the subsoil.

Most areas are used for cultivated crops. Some small areas are used for range or pasture. Bromegrass is the most commonly grown tame grass. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. The clayey subsoil restricts the movement of water into the soil and releases

moisture slowly to plants. Minimizing tillage and leaving crop residue on the surface help to prevent surface compaction, improve fertility and tilth, and increase the infiltration rate.

Alfalfa, corn, and grain sorghum are the main irrigated crops. Also, some small irrigated areas are planted to soybeans or to bromegrass for pasture. The main management needs are the efficient use of irrigation water and measures that increase the organic matter content and improve fertility and tilth. Leaving crop residue on the surface increases the organic matter content and improves tilth. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor of the taller grasses and increases the extent of the less productive shorter grasses and of weeds. Proper stocking rates, deferred grazing, and a uniform distribution of grazing, help to keep the range in good condition. If the soil is used for tame pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength and the shrink-swell potential are severe limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage resulting from low strength or from shrinking and swelling.

The slow permeability is a severe limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field improves the efficiency of the septic tank system. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIs.

Dt—Dillwyn-Tivoli complex, 0 to 15 percent slopes. This map unit dominantly consists of a deep, nearly level, somewhat poorly drained Dillwyn soil in low lying, plane or concave areas and a gently sloping to strongly sloping, excessively drained Tivoli soil on upland ridges and side slopes. Individual areas are irregular in shape and range from 40 to several hundred acres in size. They are about 50 percent Dillwyn soil and 40 percent Tivoli soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Dillwyn soil has a surface layer of brown loamy fine sand about 8 inches thick. The next 22 inches is light yellowish brown, very friable loamy fine sand. The upper part of the substratum is light yellowish brown loamy fine sand. The lower part to a depth of about 60 inches is very pale brown, mottled fine sandy loam.

Typically, the Tivoli soil has a surface layer of grayish brown fine sand about 6 inches thick. The substratum to a depth of about 60 inches is light yellowish brown fine sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Carwile soils in depressions. These included soils have a mottled, clayey subsoil. They make up 10 to 15 percent of the map unit.

Permeability is rapid in the Dillwyn and Tivoli soils. Available water capacity is low. Runoff is very slow. Natural fertility is medium in the Dillwyn soil and low in the Tivoli soil. The Dillwyn soil has a seasonal high water table at a depth of 1 to 3 feet.

Most areas support native grasses. These soils are best suited to range. The major management concerns are soil blowing and the low available water capacity. Overgrazing reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of woody plants and weeds. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

If the Dillwyn soil is used as a site for local roads and streets, wetness is a moderate limitation. If the Tivoli soil is used, slope is a moderate limitation. Constructing roads on raised fill material helps to overcome the wetness. Cutting and shaping help to overcome the slope.

These soils generally are unsuitable as sites for dwellings, septic tank absorption fields, and sewage lagoons. The wetness of the Dillwyn soil is a severe limitation. The rapid permeability of both soils is a severe limitation on sites for sanitary facilities. The soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water supplies.

The capability subclass is VIe.

Dw—Drummond silt loam. This deep, nearly level, somewhat poorly drained soil is in low areas on old lakebeds and terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 50 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. Accumulations of salts are at the surface. The subsoil is very firm clay about 22 inches thick. The upper part is grayish brown and has small accumulations of salts. The lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray silty clay loam. In some areas the surface layer is silty clay loam. In other areas the surface layer and subsoil are very dark gray silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained Tabler soils on the slightly higher flats. These soils make up 5 to 10 percent of the map unit.

Permeability is very slow in the Drummond soil. Runoff also is very slow. Available water capacity is moderate. A

seasonal high water table is at a depth of 2 to 6 feet. Natural fertility is low. The subsoil has a high shrink-swell potential. It is slightly or moderately affected by sodium and soluble salts.

Most areas support native grasses. This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of weeds. Proper stocking rates, timely deferment of grazing, rotation grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil generally is unsuited to cultivated crops because of the excessive content of salts, including sodium. Wheat and sorghum are the main crops grown in the least salty areas. Soil blowing and surface crusting are hazards in cultivated areas.

The flooding is a severe hazard if this soil is used as a site for dwellings. Also, the shrink-swell potential is a severe limitation. Overcoming the flooding is difficult without major flood control measures. Low strength and the shrink-swell potential are severe limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage resulting from low strength or from shrinking and swelling.

This soil generally is unsuitable as a septic tank absorption field because the very slow permeability and the wetness are severe limitations. It is suitable as a site for sewage lagoons only if the floodwater can be controlled.

The capability subclass is Vs.

Fa—Farnum fine sandy loam. This deep, nearly level, well drained soil is on flats in the uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface soil is grayish brown fine sandy loam about 12 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, friable loam, and the lower part is brown, firm sandy clay loam. The substratum to a depth of about 60 inches is brown, mottled fine sandy loam. In some areas, the surface layer is loam and the subsoil is more clayey. In other areas the subsoil is more sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Carwile soils, which have a mottled, clayey subsoil. These soils are in low areas. They make up 10 to 15 percent of the map unit.

Permeability is moderate in the Farnum soil. Runoff is slow. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable, and tilth is good.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Measures that control soil blowing and conserve moisture are the main management needs. Examples are minimum tillage and a cover of crop residue.

Wheat, corn, sorghum, and alfalfa are the main irrigated crops. Some small irrigated areas support bromegrass and are used as pasture. The main management needs are the efficient use of irrigation water and measures that increase the organic matter content and improve fertility and tilth. Leaving crop residue on the surface improves tilth, increases the organic matter content, and helps to control soil blowing. Soil tests help to determine the kinds and amounts of fertilizer that are needed. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation.

The moderate permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field, however, improves the efficiency of the septic tank system. Seepage is a moderate limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability subclass is IIe.

Fb—Farnum loam. This deep, nearly level, well drained soil is on flats in the uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is dark grayish brown, friable loam; the next part is brown, firm clay loam; and the lower part is pale brown, firm clay loam. The substratum to a depth of about 60 inches is brown, mottled fine sandy loam. In some areas the surface layer is fine sandy loam. In other areas the subsoil is sandier.

Included with this soil in mapping are small areas of the moderately well drained Crete soils, which have a clayey subsoil. These soils are in low areas. They make up 5 to 10 percent of the map unit.

Permeability is moderate in the Farnum soil. Runoff is slow. Available water capacity is high. Natural fertility

also is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable, and tilth is good.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is well suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Inadequate rainfall is the main limitation. The main management needs are measures that conserve moisture. Minimizing tillage and leaving crop residue on the surface conserve moisture, improve tilth, and increase the organic matter content.

Wheat, corn, sorghum, and alfalfa are the main irrigated crops. Some small irrigated areas support bromegrass and are used as pasture. The main management needs are the efficient use of irrigation water and measures that increase the organic matter content and improve fertility and tilth. Leaving crop residue on the surface improves tilth and increases the organic matter content. Soil tests help to determine the kinds and amounts of fertilizer that are needed. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation.

The moderate permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field, however, improves the efficiency of the septic tank system. Seepage is a moderate limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability subclass is IIc.

Gb—Geary silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 50 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is firm silty clay loam about 30 inches thick. The upper part is brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is light reddish brown clay loam. In some areas the surface layer is loam or fine sandy loam. In areas where it has been mixed with the upper part of the subsoil by tillage, it is silty clay loam.

Included with this soil in mapping are small areas of Harney and Uly soils. Harney soils are on the higher ridges and side slopes. Their subsoil is more clayey than that of the Geary soil. Uly soils are on the lower side slopes. They are shallower to lime than the Geary soil. Also, their subsoil is less clayey. Included soils make up 5 to 10 percent of the map unit.

Permeability is moderate in the Geary soil, and runoff is medium. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate in the subsoil. The surface soil is friable, and tilth is good.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suited to dryland crops. Wheat, sorghum, and alfalfa are the main dryland crops. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, a cover of crop residue, and minimum tillage help to control erosion, increase the organic matter content, and keep the soil in good tilth.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate and the risk of erosion. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength and frost action are severe limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome these limitations.

The moderate permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field, however, improves the efficiency of the septic tank system. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas are the better sites for lagoons.

The capability subclass is IIe.

Gc—Geary silt loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on side slopes and along drainageways in the uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is firm silty clay loam about 30 inches thick. The upper part is brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is light reddish brown clay loam. In some areas the surface layer is loam or fine sandy loam. In areas where it has been mixed with the upper part of the subsoil by tillage, it is silty clay loam. In places it is browner and is calcareous silty clay loam.

Included with this soil in mapping are small areas of Harney, Roxbury, and Uly soils. Harney soils are on the upper side slopes. Their subsoil is more clayey than that of the Geary soil. Uly soils are less reddish than the Geary soil, have a less clayey subsoil, and are more shallow to lime. They are on the lower side slopes. The occasionally flooded Roxbury soils are on narrow flood plains along drainageways. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the Geary soil, and runoff is medium. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suited to dryland crops. Wheat and sorghum are the main dryland crops. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, a cover of crop residue, and minimum tillage help to control erosion, increase the organic matter content, and keep the soil in good tilth.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses, increases the extent of the less productive shorter grasses, and increases the runoff rate and the risk of erosion. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength and frost action are severe limitations on sites for local roads and streets. Strengthening or replacing base material, however, helps to overcome these limitations.

The moderate permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field, however, improves the efficiency of the septic tank system. Slope and seepage are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas are the better sites for lagoons.

The capability subclass is IIIe.

Hb—Harney silt loam, 1 to 4 percent slopes. This deep, gently sloping, well drained soil is on upland ridges and side slopes. Individual areas are irregular in shape and range from 40 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, very firm silty clay; the next part is grayish brown, firm silty clay; and the lower part is light brownish gray, firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is light gray, calcareous silty clay loam. In places the subsoil is less clayey. In areas where the upper part of the subsoil has been mixed with the surface soil by tillage, the surface layer is silty clay loam. In some areas it is calcareous and is more clayey.

Included with this soil in mapping are small areas of Wakeen soils on the lower side slopes. These soils have chalky limestone and shale at a depth of 20 to 40 inches. They make up 3 to 5 percent of the map unit.

Permeability is moderately slow in the Harney soil, and runoff is medium. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is high in the subsoil. The surface layer is friable, and tilth is good.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways (fig. 8), contour farming, minimum tillage, and a cover of crop residue help to control erosion, increase the organic matter content, and keep the soil in good tilth.

Wheat, grain sorghum, alfalfa, and corn are the main irrigated crops. Leaving crop residue on the surface helps to keep the soil in good tilth and increases the organic matter content. Land leveling and water management improve water distribution and help to control erosion.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

If this soil is used for pasture, applications of fertilizer are needed to maintain forage production. They are especially needed if the pasture is irrigated. An adequate plant cover helps to prevent excessive runoff and erosion and increases the rate of water intake. Reseeding abandoned cropland and eroded areas with

Figure 8.—Grassed waterway and terraces on Harney silt loam, 1 to 4 percent slopes.

desirable mid and tall grasses increases forage production.

The shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with an intervening layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength and the shrink-swell potential are severe limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome these limitations.

The moderately slow permeability is a severe limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field, however, improves the efficiency of the septic tank system. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. The less sloping areas are the better sites for lagoons.

The capability subclass is IIe.

Ho—Holdrege silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on side slopes and narrow ridgetops in the uplands. Individual areas are irregular in shape and range from 50 to 500 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is brown, firm silty clay loam, and the lower part is brown, friable silt loam. The substratum to a depth of about 60 inches is light yellowish brown silt loam. In some areas, the subsoil is more clayey and the soil is dark grayish brown to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Harney and Uly soils on the lower side slopes. The subsoil of Harney soils is more clayey than that of the Holdrege soil. Uly soils are less clayey than the Holdrege soil and are less than 24 inches deep to lime. Included soils make up 5 to 10 percent of the map unit.

Permeability is moderate in the Holdrege soil, and runoff is medium. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, a cover of crop residue, and minimum tillage help to control erosion, increase the organic matter content, and keep the soil in good tilth.

Wheat, grain sorghum, alfalfa, and corn are the main irrigated crops. Leaving crop residue on the surface helps to keep the soil in good tilth and increases the organic matter content. Land leveling and water management improve water distribution and help to control erosion.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the grasses and increases the runoff rate and the risk of erosion. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Properly designing and reinforcing the dwellings and backfilling foundations with an intervening layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation.

This soil is suitable as a septic tank absorption field. It has moderate limitations as a site for sewage lagoons, however, because of seepage and slope. Sealing the lagoon helps to control seepage. The less sloping areas are the better sites for lagoons.

The capability subclass is IIe.

Hr—Hord silt loam. This deep, nearly level, well drained soil is on alluvial terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from about 80 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is friable silt loam about 27 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is pale brown silt loam. In some areas the depth to lime is less than 15 inches. In other areas the soil is not dark below a depth of 20 inches.

Included with this soil in mapping are small areas of Kaski and New Cambria soils. Kaski soils are slightly lower on the landscape than the Hord soil. Also, their subsoil is more sandy. The moderately well drained New Cambria soils are in shallow depressions. They have a clayey subsoil. Also included are frequently flooded areas on steep, narrow streambanks. Included areas make up 10 to 15 percent of the map unit.

Permeability is moderate in the Hord soil, and runoff is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Minimizing tillage and leaving crop residue on the surface increase the organic matter content and help to keep the soil in good tilth.

Wheat, grain sorghum, alfalfa, and corn are the main irrigated crops. Leaving crop residue on the surface helps to keep the soil in good tilth and increases the organic matter content. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The flooding is a severe hazard if this soil is used as a site for dwellings. It is a moderate hazard if the soil is used as a septic tank absorption field. Overcoming this hazard is difficult without major flood control measures. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. Seepage is a moderate limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability class is I.

Ka—Kaski loam. This deep, nearly level, well drained soil is on alluvial terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsurface layer is dark grayish brown, friable loam about 13 inches thick. The next 11 inches is grayish brown, friable loam. The substratum to a depth of about 60 inches is light brownish gray loam. In some areas the depth to lime is more than 15 inches. In other areas the subsoil is less clayey.

Included with this soil in mapping are small areas of Hord and Zenda soils. Hord soils are less sandy than the Kaski soil. They are on terraces, some of which are slightly higher than the terraces occupied by the Kaski soil. The somewhat poorly drained Zenda soils are on the lower flood plains. Their dark grayish brown surface layer is thinner than that of the Kaski soil. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the Kaski soil, and runoff is slow. Available water capacity is high. Natural fertility

also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Leaving crop residue on the surface and minimizing tillage increase the organic matter content and help to keep the soil in good tilth.

Wheat, grain sorghum, alfalfa, and corn are the main irrigated crops. Leaving crop residue on the surface helps to keep the soil in good tilth and increases the organic matter content. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The flooding is a severe hazard if this soil is used as a site for dwellings. It is a moderate hazard if the soil is used as a site for local roads and streets or septic tank absorption fields. Overcoming this hazard is difficult without major flood control measures. Seepage is a moderate limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability class is I.

La—Lancaster-Hedville complex, 3 to 15 percent slopes. These moderately sloping and strongly sloping soils are on uplands that generally are dissected by short, narrow, deeply entrenched drainageways. The moderately deep, well drained Lancaster soil is on side slopes and foot slopes. The shallow, somewhat excessively drained Hedville soil is on the steeper upper side slopes and ridges and along drainageways (fig. 9). Individual areas range from 20 to several hundred acres in size. They are about 55 percent Lancaster soil and 30 percent Hedville soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Lancaster soil has a dark grayish brown loam surface layer about 8 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable loam; the next part is brown, firm sandy clay loam; and the lower part is light brown, friable fine sandy loam. Weathered sandy shale is at a depth of about 34 inches. In some areas sandy shale is at a depth of 40 to 60 inches. In other areas the subsoil is more clayey and is mottled in the lower part.

Typically, the Hedville soil has a dark grayish brown fine sandy loam surface layer about 10 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 6 inches thick. Sandstone bedrock is at a depth of about 16 inches. In some areas the surface layer and subsurface layer have concretions and soft masses of lime. In other areas the content of rounded

Figure 9.—Profile of Hedville fine sandy loam. This soil is shallow over sandstone.

and angular sandstone fragments is 30 to 40 percent in the surface layer.

Included with these soils in mapping are small areas of Geary soils, small areas of loamy alluvial soils, and small areas where clayey shale and sandstone crop out. The deep, well drained Geary soils are on the upper side slopes and on foot slopes. The deep, well drained, noncalcareous loamy alluvial soils are along narrow drainageways and are occasionally flooded. The areas where sandstone and clayey shale crop out are on the steeper side slopes. Included areas make up 10 to 15 percent of the map unit.

Permeability is moderate in the Lancaster and Hedville soils. Available water capacity is moderate in the Lancaster soil and very low in the Hedville soil. Natural fertility is medium in both soils. Root penetration is restricted below a depth of about 34 inches in the Lancaster soil and about 16 inches in the Hedville soil. Surface runoff is medium on both soils. The shrink-swell potential is moderate in the subsoil of the Lancaster soil.

Most areas are used as range. These soils generally are unsuitable for cultivation because of a severe hazard of erosion. They are best suited to range. Continued overgrazing reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of weeds and brush. Range seeding is needed to restore productivity on abandoned cropland. Measures that control the plants competing with the native grasses are needed. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

If the Lancaster soil is used as a site for dwellings with basements, the shrink-swell potential, the slope, and the depth to rock are moderate limitations. If the Hedville soil is used as a site for dwellings, the depth to rock is a severe limitation. Ripping the rock generally improves workability. Cutting and shaping help to overcome the slope of the Lancaster soil. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the damage to buildings caused by shrinking and swelling.

If the Lancaster soil is used as a site for local roads and streets, low strength, frost action, and slope are moderate limitations. If the Hedville soil is used, the depth to rock is a severe limitation. Strengthening or replacing base material helps to prevent the damage caused by frost action and low strength. Cutting and shaping help to overcome the slope of the Lancaster soil. Ripping the rock in the Hedville soil generally improves workability. In areas where the rock is dense, however, an alternative route for the roads and streets should be selected.

These soils generally are unsuitable as sites for septic tank absorption fields and sewage lagoons, mainly because the depth to rock is a severe limitation.

The capability subclass is VIe.

Na—Naron fine sandy loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on low ridges in the uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is dark grayish brown, friable loam, and the lower part is brown, friable sandy clay loam. The substratum to a depth of about 60 inches is light brown fine sandy loam. In some areas the subsoil is clay loam. In other areas the lower part of the subsoil is more silty and is calcareous.

Included with this soil in mapping are small areas of the somewhat poorly drained Carwile soils in depressions. These soils have a mottled, clayey subsoil. They make up 10 to 15 percent of the map unit.

Permeability is moderate in the Naron soil, and runoff is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. If cultivated crops are grown, soil blowing is the main hazard. Stripcropping, a cover of crop residue, and minimum tillage help to control soil blowing, increase the organic matter content, and keep the soil in good tilth.

Wheat, grain sorghum, alfalfa, and corn are the main irrigated crops. Leaving crop residue on the surface helps to keep the soil in good tilth, increases the organic matter content, and helps to control soil blowing. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

This soil is suitable as a site for dwellings, septic tank absorption fields, and local roads and streets. Seepage is a severe limitation on sites for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIe.

Nb—Ness silty clay. This deep, nearly level, poorly drained soil is in depressions on uplands and valley floors. It is frequently flooded for long or very long periods. Individual areas are round or irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is gray silty clay about 10 inches thick. The subsurface layer is dark gray, very firm silty clay about 20 inches thick. The substratum to a

depth of about 60 inches is light brownish gray silty clay. In some areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained, nearly level Crete, New Cambria, and Tabler soils. These soils are higher on the landscape than the Ness soil. They make up 5 to 10 percent of the map unit.

Permeability is very slow in the Ness soil, and runoff is ponded. Available water capacity is moderate. Natural fertility is high. The surface layer is very firm and can be tilled only within a narrow range of moisture content. A seasonal high water table is near or above the surface. The shrink-swell potential is high.

In most areas this soil is cultivated along with the surrounding soils. It is poorly suited, however, to dryland crops. Because of the ponding, it also is poorly suited to range. Wheat and sorghum are the main dryland crops. The main management needs are measures that control ponding and soil blowing. An open drainage system generally is effective in controlling ponding. A cover of crop residue and emergency tillage help to control soil blowing during dry periods.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons, mainly because the ponding and the flooding are severe hazards.

The capability subclass is VIw.

Nc—New Cambria silty clay loam. This deep, nearly level to slightly concave, moderately well drained soil is on terraces along the larger streams. It is subject to rare flooding. Individual areas are irregular in shape and range from about 50 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, firm silty clay about 7 inches thick. The subsoil is very firm silty clay about 17 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum to a depth of about 60 inches is grayish brown silty clay loam. In some areas the surface layer is grayish brown silt loam. In other areas the subsoil is less clayey.

Included with this soil in mapping are small areas of the well drained Bridgeport soils. These soils are less clayey than the New Cambria soil. They are in the slightly higher areas next to streams. They make up 3 to 5 percent of the map unit.

Permeability is slow in the New Cambria soil. Runoff also is slow. Available water capacity is high. Natural fertility also is high. The surface layer is firm, and tilling is difficult. If the surface layer is tilled when too wet or too dry, large clods form. The shrink-swell potential is high.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. This soil is suited to dryland crops. Wheat, sorghum, and alfalfa are the main dryland crops. The clayey subsoil restricts the movement of water into the soil and releases moisture slowly to plants. Leaving crop residue on the surface and minimizing tillage increase the organic matter content and help to keep the soil in good tilth.

This soil is only moderately well suited to irrigated crops, mainly because of the slow permeability. Wheat, grain sorghum, and alfalfa are the main irrigated crops. Leaving crop residue on the surface helps to keep the soil in good tilth and increases the organic matter content. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

This soil generally is unsuitable as a site for dwellings because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures. Low strength and the shrink-swell potential are severe limitations on sites for local roads. Strengthening or replacing the base material, however, helps to prevent the damage resulting from low strength or from shrinking and swelling.

Because the slow permeability is a severe limitation, this soil generally is unsuitable as a septic tank absorption field. It is suitable, however, as a site for sewage lagoons.

The capability subclass is IIs.

Nw—Nibson-Wakeen silt loams, 3 to 15 percent slopes. These moderately sloping and strongly sloping soils are on uplands that generally are dissected by shallow drainageways. The shallow, somewhat excessively drained Nibson soil is on the steeper upper sides and narrow tops of ridges and on the steeper lower side slopes along drainageways. The moderately deep, well drained Wakeen soil is on the upper side slopes and broad ridgetops above the Nibson soil. Individual areas range from 20 to several hundred acres in size. They are about 50 percent Nibson soil and 40 percent Wakeen soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Nibson soil is dark grayish brown silt loam about 8 inches thick. The subsoil is very pale brown, friable silt loam about 6 inches thick. The substratum is very pale brown silt loam about 5 inches thick. Chalky shale and soft limestone are at a depth of about 19 inches. In some areas the depth to shale or limestone is less than 10 inches.

Typically, the surface layer of the Wakeen soil is dark grayish brown silt loam about 12 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is light brownish gray, and the lower part

is very pale brown. Soft chalky shale or limestone is at a depth of about 36 inches. In some areas the depth to chalky shale is more than 40 inches.

Included with these soils in mapping are small areas of the deep, well drained Harney and Roxbury soils and small areas where limestone crops out. Harney soils are on ridgetops. Their subsoil is more clayey than that of either the Nibson or the Wakeen soil. Roxbury soils are on narrow flood plains along drainageways. The areas where limestone crops out are on the steeper short side slopes. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the Nibson and Wakeen soils. Available water capacity is low in the Nibson soil and moderate in the Wakeen soil. Runoff is rapid on both soils. Natural fertility is medium. Root penetration is restricted below a depth of about 19 inches in the Nibson soil and 36 inches in the Wakeen soil. The shrink-swell potential is moderate in both soils.

Most areas are used as range. Although small areas are used as cropland, these soils generally are unsuitable for cultivation because of a severe erosion hazard. They are best suited to range. The major concerns of management are the hazard of erosion and the low and moderate available water capacity. Overgrazing reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. An adequate plant cover reduces the runoff rate and the risk of erosion. Range seeding is needed to restore productivity on abandoned cropland. Proper stocking rates, a uniform distribution of grazing, and deferred grazing help to keep the range in good condition.

The shrink-swell potential and the slope are moderate limitations if these soils are used as sites for dwellings without basements. Also, the depth to rock in the Nibson soil is a moderate limitation. The rock generally is soft, however, and can be fractured and ripped by the commonly used construction equipment. Properly designing and reinforcing the dwellings and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Cutting and shaping help to overcome the slope.

Low strength is a severe limitation if these soils are used as sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation.

These soils generally are unsuitable as sites for septic tank absorption fields and sewage lagoons, mainly because the depth to rock is a severe limitation.

The capability subclass is VIe.

Pa—Platte fine sandy loam. This deep, nearly level, somewhat poorly drained soil is on flood plains along the Arkansas River (fig. 10). It is occasionally flooded. Individual areas are irregular in shape and range from about 10 to a few hundred acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 9 inches thick. The upper part of the substratum is pale brown loamy fine sand. The lower part to a depth of about 60 inches is pale brown sand. In some areas the surface layer and substratum are more clayey.

Included with this soil in mapping are small areas of Zenda and Waldeck soils on the slightly higher flood plains. These soils contain more clay in the subsoil than the Platte soil. They make up 5 to 10 percent of the map unit.

Permeability is very rapid in the Platte soil, and runoff is slow. Available water capacity is low. Natural fertility also is low. A seasonal high water table is at a depth of 1 to 2 feet.

Most areas support native grasses. This soil is suited to range. Overstocking and overgrazing, however, decrease the extent of the taller grasses and increase the extent of the less productive shorter grasses and of trees and brush. Proper stocking rates, deferred grazing, a uniform distribution of grazing, and measures that control small trees and brush help to keep the range in good condition.

This soil generally is unsuited to cultivated crops because of the flooding, the low available water capacity, and the low natural fertility. Wheat and sorghum are the main crops. If cultivated crops are grown, measures that conserve moisture and control soil blowing are needed. Leaving crop residue on the surface improves fertility and tilth, increases the organic matter content, and helps to control soil blowing.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures. The soil is a probable source of sand.

The capability subclass is IVw.

Pd—Pratt loamy fine sand, undulating. This deep, undulating, well drained soil is on uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is yellowish brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown loamy fine sand. In some areas the subsoil is more clayey. In other areas lime is at a depth of about 30 to 40 inches.

Included with this soil in mapping are small areas of Carwile and Naron soils. The somewhat poorly drained Carwile soils are in depressions. They have a mottled, clayey subsoil. Naron soils have a sandy clay loam subsoil. They are on the lower side slopes. Included soils make up 10 to 15 percent of the map unit.

Figure 10.—A typical area of Platte fine sandy loam near the Arkansas River.

Permeability is rapid in the Pratt soil, and runoff is slow. Available water capacity is low. Natural fertility also is low. The surface layer is loose and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suitable for dryland and irrigated crops. Wheat and sorghum are the main dryland crops. Soil blowing is the major concern of management. A cover of crop residue, minimum tillage, and wind stripcropping help to control soil blowing and conserve moisture.

Sorghum, corn, and alfalfa are the major irrigated crops. Minimum tillage and a cover of crop residue help to control soil blowing, increase the organic matter content, and improve tilth and fertility.

This soil is suited to range. If the range is overstocked and overgrazed, however, the extent of the protective plant cover is reduced and the taller grasses are replaced by less productive short grasses and by brush. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil is suitable as a site for dwellings and local roads and streets. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the contamination of shallow ground water. Seepage is a severe limitation on sites for sewage lagoons, but it can be controlled by sealing the lagoon.

The capability subclass is IIIe.

Pr—Pratt loamy fine sand, rolling. This deep, rolling, well drained soil is on uplands. Individual areas are irregular in shape and range from 20 to 200 acres in size.

Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is yellowish brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown loamy fine sand. In some areas the subsoil is fine sandy loam. In other areas it is more sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Carwile soils in depressions. These soils have a mottled, clayey subsoil. They make up 2 to 5 percent of the map unit.

Permeability is rapid in the Pratt soil, and runoff is slow. Available water capacity is low. Natural fertility also is low. The surface layer is loose and can be easily tilled.

Most areas are used for cultivated crops. Some areas are used as range. This soil is poorly suited to dryland crops. The main dryland crops are wheat and sorghum. The major hazard is soil blowing. Stripcropping, minimum tillage, and a cover of crop residue help to control soil blowing, conserve moisture, increase the organic matter content, and improve tilth and fertility.

This soil is suited to irrigated crops. Sorghum, alfalfa, and corn are the major irrigated crops. Minimum tillage and a cover of crop residue help to control soil blowing, increase the organic matter content, and improve tilth and fertility.

This soil is suited to range. A cover of native grasses is effective in controlling soil blowing. If the range is overstocked and overgrazed, the extent of the protective plant cover is reduced and the taller grasses are replaced by less productive shorter grasses and by brush. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The slope is a moderate limitation if this soil is used as a site for dwellings or local roads and streets. The less sloping areas are the better sites. Cutting and shaping are needed in the more sloping areas.

Mainly because seepage is a severe limitation, this soil generally is unsuitable as a site for sewage lagoons. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the contamination of shallow ground water.

The capability subclass is IVe.

Ps—Pratt-Carwile loamy fine sands, 0 to 5 percent slopes. These deep, nearly level and gently sloping soils are on uplands. The well drained Pratt soil is on ridges and side slopes. The somewhat poorly drained Carwile soil is in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 40 to several hundred acres in size. They are about 60 percent Pratt soil and 30 percent Carwile soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Pratt soil has a brown loamy fine sand surface layer about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is yellowish brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown loamy fine sand. In some areas the subsoil is fine sandy loam.

Typically, the Carwile soil has a brown loamy fine sand surface layer about 5 inches thick. The subsurface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, mottled, friable sandy clay loam; the next part is grayish brown, mottled, very firm clay; and the lower part is gray, mottled, firm clay. The substratum to a depth of about 60 inches is light gray, mottled clay. In some areas the surface layer is loam.

Included with these soils in mapping are small areas of Naron and Farnum soils. Naron soils have a sandy clay loam subsoil. They are on side slopes below the Pratt soil. Farnum soils have a clay loam subsoil. They are nearly level and are above the Carwile soil on the landscape. Included soils make up 10 to 15 percent of the map unit.

Permeability is rapid in the Pratt soil and slow in the Carwile soil. Runoff is slow on the Pratt soil and slow to ponded on the Carwile soil. Available water capacity is low in the Pratt soil and high in the Carwile soil. Natural fertility also is low in the Pratt soil and high in the Carwile soil. The shrink-swell potential is high in the subsoil of the Carwile soil. This soil has a seasonal high water table near or above the surface.

Most areas are used for dryland and irrigated crops. Some small areas are used as range. These soils are suited to dryland crops. Sorghum and wheat are the main dryland crops. Soil blowing is the main hazard. Minimizing tillage and leaving crop residue on the surface help to control soil blowing, increase the organic matter content, and improve tilth and fertility. A surface drainage system is needed in some depressional areas.

The Pratt soil is suited to irrigated crops, but the Carwile soil is poorly suited because it is somewhat poorly drained. Sorghum, alfalfa, and corn are the major irrigated crops. Minimum tillage, wind stripcropping, and a tillage system that leaves crop residue on the surface help to control soil blowing and conserve moisture. The cover of crop residue also increases the organic matter content and improves tilth and fertility. Open ditches improve surface drainage in low areas. Land leveling and water management improve water distribution.

These soils are suited to range. A cover of native grasses is effective in controlling soil blowing. If the range is overstocked and overgrazed, the extent of the protective plant cover is reduced and the taller grasses are replaced by less productive short grasses and by brush. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The Pratt soil is suitable as a site for dwellings or local roads and streets. The ponding and shrink-swell potential of the Carwile soil, however, are severe limitations. Also, low strength is a severe limitation if the Carwile soil is used as a site for local roads and streets. Properly designing and reinforcing dwellings, installing foundation drains, and backfilling foundations with a layer of coarse material help to prevent the damage caused by shrinking and swelling. A surface drainage system can keep water away from dwellings.

Strengthening or replacing the base material of local roads and streets helps to prevent the damage resulting from low strength or from shrinking and swelling. A surface drainage system and filling and shaping low areas help to prevent the damage caused by ponding.

The Pratt soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the contamination of shallow ground water. The Carwile soil generally is unsuitable as a septic tank absorption field because the slow permeability and ponding are severe limitations. It is suitable as a site for sewage lagoons only if the ponding is controlled. Seepage is a severe limitation if the Pratt soil is used as a site for sewage lagoons. It can be controlled, however, by sealing the lagoon.

The capability subclass is IIIe.

Pt—Pratt-Tivoli loamy fine sands, rolling. These deep soils are on uplands. The well drained Pratt soil is on side slopes, and the excessively drained Tivoli soil is on narrow ridgetops. Individual areas are irregular in shape and range from 50 to several hundred acres in size. They are about 60 percent Pratt soil and 35 percent Tivoli soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Pratt soil has a brown loamy fine sand surface layer about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is yellowish brown, very friable loamy fine sand about 16 inches thick. The substratum to a depth of about 60 inches is light yellowish brown loamy fine sand.

Typically, the Tivoli soil has a grayish brown loamy fine sand surface layer about 6 inches thick. The substratum to a depth of about 60 inches is light yellowish brown fine sand. In some areas the surface layer is fine sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Carwile soils in depressions. These soils have a mottled, clayey subsoil. They make up 5 to 10 percent of the map unit.

Permeability is rapid in the Pratt and Tivoli soils, and runoff is slow. Available water capacity is low. Natural fertility also is low.

Most areas are used as range. These soils generally are unsuitable for cultivation because of a severe hazard of soil blowing. They are suited to range. The major concern in managing range is soil blowing. If the range is overstocked and overgrazed, the extent of the protective plant cover is reduced and the taller grasses are replaced by less productive short grasses and by brush. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition and help to control soil blowing.

The slope is a moderate limitation if these soils are used as sites for dwellings or local roads and streets. It generally can be overcome, however, by cutting and shaping. Mainly because seepage is a severe limitation, the soils generally are unsuitable as sites for sewage lagoons. They readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the contamination of shallow ground water.

The capability subclass is VIe.

Ra—Roxbury silt loam, flooded. This deep, nearly level, well drained soil is on flood plains along small creeks and drainageways. It is occasionally flooded (fig. 11). Individual areas range from 20 to several hundred acres in size and are 200 to 800 feet wide and a quarter of a mile to several miles long.

Typically, the surface soil is dark grayish brown silt loam about 20 inches thick. The subsoil is dark grayish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is light brownish gray and pale brown silt loam. In some areas the subsoil is lighter in color. In other areas the subsoil is more sandy and the substratum more sandy or more clayey. In places, the surface soil and subsoil are more clayey and the depth to lime is more than 15 inches.

Permeability is moderate in the Roxbury soil, and runoff is slow. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate in the subsoil. The surface soil is friable and can be easily tilled.

About half the acreage is used for cultivated crops. The rest is used mainly as range. This soil is suited to dryland crops. Wheat, sorghum, and alfalfa are the main dryland and irrigated crops. Corn also is grown in irrigated areas. Flooding and the resulting siltation damage crops in some years, but in other years the crops may benefit from the extra moisture. The main management needs are measures that control the floodwater and maintain fertility and tilth. Embankments, dikes, and levees lessen the flood hazard. Leaving crop residue on the surface and minimizing tillage increase the organic matter content and help to maintain a high level of fertility and good tilth. Land leveling and water management improve the distribution of irrigation water.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIw.

Ta—Tabler silt loam. This deep, nearly level, moderately well drained soil is in slight depressions in the uplands. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Figure 11.—A typical area of Roxbury silt loam, flooded. This soil supports scattered stands of native trees.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is about 31 inches thick. The upper part is very dark grayish brown and dark grayish brown, very firm silty clay, and the lower part is brown, very firm silty clay loam. The substratum to a depth of about 60 inches is pale brown silty clay loam. In some areas it is distinctly mottled and has strata of loamy, calcareous material. In other areas, the surface layer is loam or fine sandy loam and the subsoil is less clayey.

Included with this soil in mapping are small areas of Crete soils. These soils are less clayey in the upper part of the subsoil than the Tabler soil. They are on the slightly higher flats. They make up about 5 to 10 percent of the map unit.

Permeability is very slow in the Tabler soil, and runoff is slow. A seasonal high water table is at a depth of 2.5 to 3.5 feet. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is high in the subsoil. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range or pasture. Bromegrass is the most commonly grown tame grass in the areas used as pasture. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main dryland crops. Because of the dense clayey subsoil, the intake of moisture and the release of moisture to plants are slow. Leaving crop residue on the surface and minimizing tillage increase the rate of water intake and the organic matter content and improve tilth.

Wheat, grain sorghum, alfalfa, and corn are the main irrigated crops. Leaving crop residue on the surface increases the rate of water intake and the organic matter content and improves tilth. Land leveling and water management improve water distribution.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition. If the soil is used for tame pasture, applications of fertilizer are needed to increase forage production. They are especially needed if the pasture is irrigated.

The shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome these limitations.

Because the very slow permeability and the wetness are severe limitations, this soil generally is unsuitable as a septic tank absorption field. It is suitable, however, as a site for sewage lagoons.

The capability subclass is IIs.

Tb—Tabler-Drummond silt loams. These deep, nearly level soils are on low upland lakebeds and in low areas adjacent to drainageways. The moderately well drained Tabler soil is in the slightly higher convex areas. The somewhat poorly drained Drummond soil generally is in the lower concave areas. It is subject to rare flooding. Individual areas range from 50 to several hundred acres in size. They are about 70 percent Tabler soil and 20 percent Drummond soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Tabler soil has a surface layer of very dark grayish brown silt loam about 10 inches thick. The subsoil is about 31 inches thick. The upper part is very dark grayish brown and dark grayish brown, very firm silty clay, and the lower part is brown, very firm silty clay loam. The substratum to a depth of about 60 inches is pale brown silty clay loam. In some areas it is distinctly mottled and contains a large amount of lime. In other areas the surface layer is loam or clay.

Typically, the Drummond soil has a surface layer of grayish brown silt loam about 8 inches thick. It has accumulations of salts at the surface. The subsoil is very firm clay about 22 inches thick. The upper part is grayish brown and has small accumulations of salts, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is light brownish gray silty clay loam. In some areas the surface layer is silty clay loam. In other areas the surface layer and subsoil are very dark gray silty clay loam.

Included with these soils in mapping are small areas of Crete and New Cambria soils. These soils do not have accumulations of sodium and other salts in the subsoil. Crete soils are in the slightly higher areas, and New Cambria soils are on terraces along drainageways. Included soils make up 5 to 10 percent of the map unit.

Permeability is very slow in the Tabler and Drummond soils, and runoff is slow or very slow. A seasonal high water table is at a depth of 2.5 to 3.5 feet in the Tabler soil and 2 to 6 feet in the Drummond soil. Available water capacity is high in the Tabler soil and moderate in the Drummond soil. Natural fertility is high in the Tabler soil and low in the Drummond soil. The shrink-swell potential is high in the subsoil of both soils. The surface layer is friable and can be easily tilled, but it crusts when dry.

About half the areas are used for cultivated crops. The rest are used mainly as range. Wheat, sorghum, and alfalfa are the main dryland crops. These soils are poorly suited to dryland crops because of the clayey subsoil in both soils and the low natural fertility and excess salts in the Drummond soil (fig. 12). Also, soil blowing is a hazard. Leaving crop residue on the surface and minimizing tillage help to prevent surface crusting, help to control soil blowing, conserve moisture, increase the organic matter content, and improve tilth. The soils generally are not suitable for irrigated crops.

These soils are suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of weeds. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The shrink-swell potential is a severe limitation if the Tabler soil is used as a site for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. The Drummond soil generally is unsuitable as a site for dwellings because the flooding is a severe hazard. Low strength and the shrink-swell potential are severe limitations if either of the soils is used as a site for local roads and streets. Strengthening or replacing the base material, however, helps to overcome these limitations.

These soils generally are unsuitable as septic tank absorption fields because the very slow permeability and the wetness are severe limitations. The Tabler soil is suitable as a site for sewage lagoons, but the Drummond soil is unsuitable because the flooding is a severe hazard.

The capability subclass is IVs.

Tv—Tivoli fine sand, hilly. This deep, hilly, excessively drained soil is on uplands. Individual areas are irregular in shape and range from 40 to 500 acres in size.

Typically, the surface layer is grayish brown fine sand about 6 inches thick. The substratum to a depth of about 60 inches is light yellowish brown fine sand. In some areas the soil has a subsoil of loamy fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Dillwyn and Carwile soils in depressions. Dillwyn soils have a loamy fine sand surface layer and a mottled loamy fine sand subsoil. Carwile soils have a mottled, clayey subsoil. Included soils make up 10 to 15 percent of the map unit.

Permeability is rapid in the Tivoli soil, and runoff is very slow. Available water capacity is low. Natural fertility also is low.

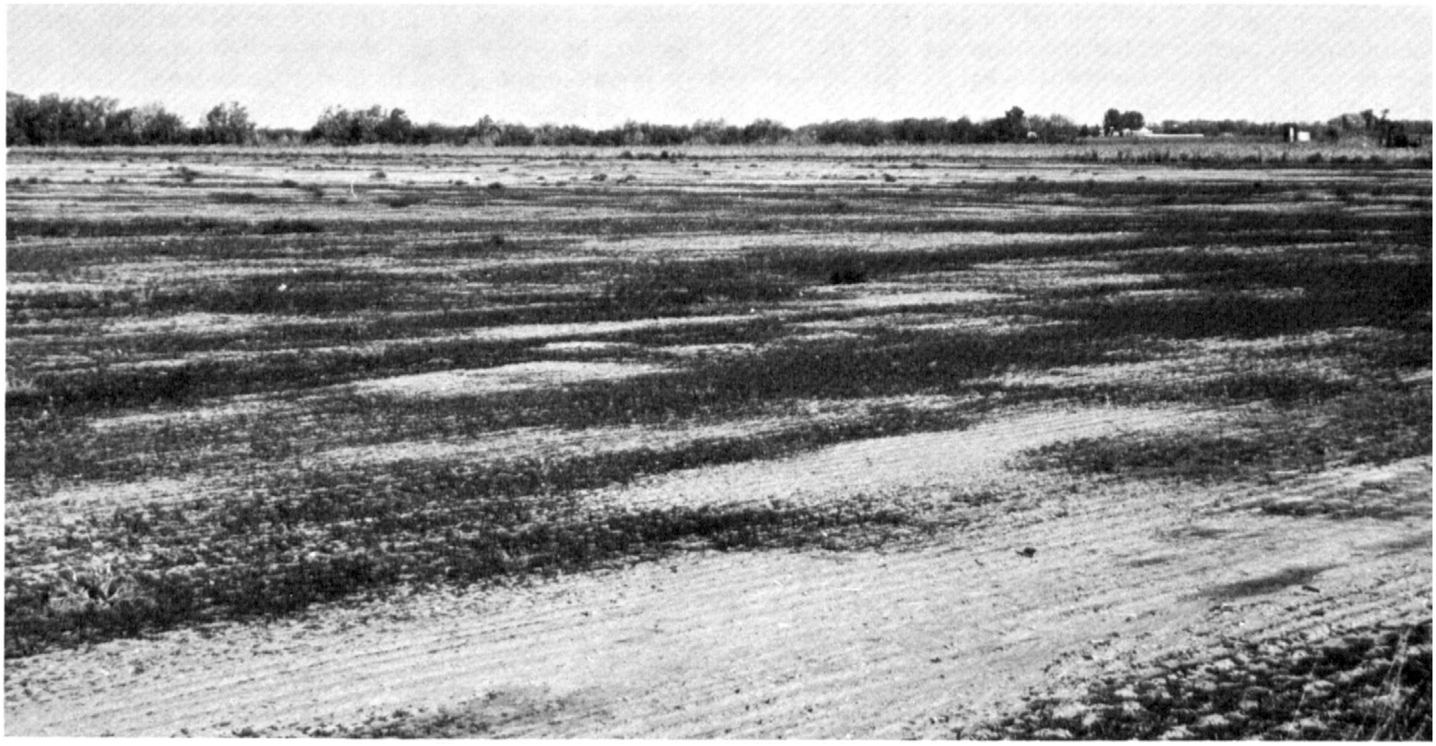

Figure 12.—A cropped area of Tabler-Drummond silt loams. Yields are low.

Most areas support native grasses. This soil generally is not suitable for dryland or irrigated crops because of the hazard of soil blowing, the slope, and the low available water capacity. It is best suited to range. The major problems in managing range are the hazard of soil blowing, the low available water capacity, and the low natural fertility. An adequate plant cover is needed to control soil blowing. Overstocking and overgrazing reduce the extent of the protective plant cover and cause deterioration of the plant community. Under these conditions, the more desirable taller grasses are replaced by less productive short grasses or by brush. Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the range in good condition and help to control soil blowing.

The slope is a severe limitation if this soil is used as a site for dwellings, local roads and streets, or sanitary facilities. As a result of the slope, the soil generally is unsuitable as a site for dwellings or local roads and streets. As a result of seepage and slope, it generally is unsuitable as a site for sewage lagoons. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the contamination of shallow ground water.

The capability subclass is VIIe.

Ub—Uly silt loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from about 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam about 29 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is light yellowish brown, calcareous silt loam. In some areas the subsoil is more clayey. In other areas it is more sandy in the upper part. In places chalky limestone is within a depth of 40 inches.

Included with this soil in mapping are small areas of Geary and Harney soils. Geary soils are on the lower side slopes. Their subsoil is more reddish and more clayey than that of the Uly soil. Harney soils are on ridgetops and the upper side slopes. Their subsoil is more clayey than that of the Uly soil. Included soils make up 3 to 5 percent of the map unit.

Permeability is moderate in the Uly soil, and runoff is medium. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suited to dryland crops. Wheat and sorghum are the main dryland crops. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by terraces, grassed waterways, contour farming, and minimum tillage. Leaving crop

residue on the surface reduces the runoff rate and the risk of erosion, increases the infiltration rate and the organic matter content, and helps to keep the soil in good tilth.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil is suitable as a site for dwellings or septic tank absorption fields. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing base material, however, helps to overcome this limitation. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. Cutting and shaping help to overcome the slope.

The capability subclass is IIIe.

Wa—Wakeen silt loam, 1 to 3 percent slopes. This moderately deep, gently sloping, well drained soil is on side slopes and ridgetops in the uplands. Individual areas are irregular in shape and range from about 10 to several hundred acres in size.

Typically, the surface soil is dark grayish brown silt loam about 14 inches thick. The subsoil is friable silty clay loam about 22 inches thick. The upper part is light brownish gray, and the lower part is very pale brown. Soft chalky shale or limestone is at a depth of about 36 inches. In some areas the depth to chalky shale or limestone is more than 40 inches.

Included with this soil in mapping are small areas of the deep, moderately slowly permeable Harney soils on ridgetops. These soils make up 5 to 10 percent of the map unit.

Permeability and available water capacity are moderate in the Wakeen soil. Runoff is medium. Natural fertility also is medium. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled. Root penetration is restricted at a depth of about 36 inches.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suited to wheat and sorghum. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, a cover of crop residue, and minimum tillage help to control erosion, increase the organic matter content, and keep the soil in good tilth.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Also, the depth to rock is a moderate limitation on sites for dwellings with basements. The rock generally is soft, however, and can be fractured and ripped by the commonly used construction equipment. Properly designing and reinforcing foundations, installing foundation drains, and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing base material, however, helps to overcome this limitation.

This soil generally is unsuitable as a site for septic tank absorption fields and sewage lagoons because the depth to rock is a severe limitation.

The capability subclass is IIIe.

Wb—Wakeen silt loam, 3 to 6 percent slopes. This moderately deep, moderately sloping, well drained soil is on the lower sides of drainageways in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface soil is dark grayish brown silt loam about 12 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is light brownish gray, and the lower part is very pale brown. Soft chalky shale or limestone is at a depth of about 36 inches. In some areas the depth to chalky shale is more than 40 inches. In other areas it is less than 20 inches. In places the surface layer is grayish brown.

Included with this soil in mapping are small areas of the deep Geary, Harney, and Roxbury soils. Geary soils have a reddish subsoil. They are on the upper side slopes. Harney soils are on ridgetops and the upper side slopes. Their subsoil is more clayey than that of the Wakeen soil. Roxbury soils are on flood plains along upland drainageways. Included soils make up 10 to 15 percent of the map unit.

Permeability and available water capacity are moderate in the Wakeen soil. Runoff is medium. Natural fertility also is medium. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled. Root penetration is restricted at a depth of about 36 inches.

About half the acreage is used for cultivated crops. The rest is used mainly as range. This soil is suited to wheat and sorghum. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, a cover of crop residue, and minimum tillage help to control erosion, increase the organic matter content, and keep the soil in good tilth.

This soil is suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Also, the depth to rock is a moderate limitation on sites for dwellings with basements. The rock generally is soft, however, and can be fractured and ripped by the commonly used construction equipment. Properly designing and reinforcing foundations, installing foundation drains, and backfilling foundations with a layer of sand and gravel or crushed rock help to prevent the damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing base material, however, helps to overcome this limitation.

This soil generally is unsuitable as a site for septic tank absorption felds and sewage lagoons because the depth to rock is a severe limitation.

The capability subclass is IVe.

Wc—Waldeck fine sandy loam. This deep, nearly level, somewhat poorly drained soil is on flood plains along the Arkansas River. It is occasionally flooded for brief periods. Individual areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 11 inches thick. The next 10 inches is pale brown, very friable fine sandy loam. The upper part of the substratum is very pale brown sandy loam. The lower part to a depth of about 60 inches is light yellowish brown fine sand. In some areas the surface layer is loamy sand or loamy fine sand. In other areas, the surface layer and subsoil are dark grayish brown clay loam and the substratum has thin strata of loam or clay loam. In places the soil is loam throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Platte and Zenda soils. Platte soils are more sandy than the Waldeck soil. They are on the lower flood plains. Zenda soils are less sandy than the Waldeck soil. They are at about the same level on the flood plain as the Waldeck soil. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderately rapid in the Waldeck soil, and runoff is slow. Available water capacity is moderate. Natural fertility is high. A seasonal high water table is at a depth of 2 to 4 feet.

Most areas are used for cultivated crops. Some areas are used as range. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main crops. In some years crops are damaged by floodwater. They benefit from the moisture in the root zone provided by the seasonal high water table. Soil blowing is a hazard in the cropped areas. Leaving crop residue on the surface helps to control soil blowing, increases the organic matter content, and improves tilth and fertility. Wind stripcropping and minimum tillage also help to control soil blowing.

This soil is suited to range (fig. 13). The extra moisture available from the water table is beneficial. Overgrazing reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of weeds and brush. Proper stocking rates, a uniform distribution of grazing, and deferred grazing help to keep the range in good condition.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIIw.

Za—Zenda loam. This deep, nearly level, somewhat poorly drained soil is on flood plains along the Arkansas River. It is occasionally flooded for very brief periods. Individual areas are irregular in shape and range from about 40 to several hundred acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark grayish brown, friable loam about 12 inches thick. The next 8 inches is grayish brown, friable clay loam. The substratum to a depth of about 60 inches is pale brown, mottled clay loam. In some areas sand is within a depth of 40 inches. In other areas the subsurface layer is more clayey and has small accumulations of salts. In places the soil is dark grayish brown to a depth of more than 20 inches and is mottled at a depth of more than 30 inches.

Included with this soil in mapping are small areas of Platte and Waldeck soils. These soils are more sandy throughout than the Zenda soil. They are at about the same level on the flood plain as the Zenda soil. They make up 3 to 5 percent of the map unit.

Permeability is moderate in the Zenda soil, and runoff is slow. A seasonal high water table is at a depth of 2 to 4 feet. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate. The surface layer is very friable and can be easily tilled.

Most areas are used for cultivated crops. Some small areas are used as range. This soil is suited to dryland and irrigated crops. Wheat, sorghum, and alfalfa are the main crops. In some years crops are damaged by floodwater. They benefit from the moisture in the root zone provided by the seasonal high water table. Soil blowing is hazard in the cultivated areas. Minimizing tillage and leaving crop residue on the surface increase the organic matter content, help to keep the soil in good tilth, and help to control soil blowing.

This soil is suited to range. The extra moisture available from the water table is beneficial. Overgrazing reduces the vigor and retards the growth of the taller grasses and increases the extent of the less productive shorter grasses and of weeds and brush. Proper stocking rates, a uniform distribution of grazing, and deferred grazing help to keep the range in good condition.

This soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and

Figure 13.—An area of Waldeck fine sandy loam used as range.

sewage lagoons because the flooding is a severe hazard. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIw.

prime farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cropland, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber or is available for those uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at local offices of the Soil Conservation Service.

About 450,500 acres in Barton County, or 80 percent of the total acreage, meets the requirements for prime farmland. Nearly all the acreage of associations 1, 3, and 6, which are described under the heading "General soil map units," is prime farmland. About 75 percent of the acreage of associations 2 and 4 and 40 percent of the acreage of association 5 are prime farmland.

The map units considered prime farmland in the county are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4.

The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed soil map units."

The map units that meet the requirements for prime farmland are:

Ba—Bridgeport silt loam
Ca—Canadian fine sandy loam
Cr—Crete silt loam
Fa—Farnum fine sandy loam
Fb—Farnum loam
Gb—Geary silt loam, 1 to 3 percent slopes
Gc—Geary silt loam, 3 to 7 percent slopes
Hb—Harney silt loam, 1 to 4 percent slopes
Ho—Holdrege silt loam, 1 to 3 percent slopes
Hr—Hord silt loam
Ka—Kaski loam
Na—Naron fine sandy loam, 0 to 3 percent slopes
Nc—New Cambria silty clay loam
Ra—Roxbury silt loam, flooded
Ta—Tabler silt loam
Ub—Uly silt loam, 3 to 6 percent slopes
Wa—Wakeen silt loam, 1 to 3 percent slopes
Wb—Wakeen silt loam, 3 to 6 percent slopes
Wc—Waldeck fine sandy loam
Za—Zenda loam

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Earl J. Bondy, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 97 percent of the cropland in Barton County was used for crops or was summer fallowed during the period 1967 to 1977. Wheat was grown on about 53 percent of the cropland, sorghum on 12 percent, and other crops, such as alfalfa, corn, and hay, on 11 percent. The rest was summer fallowed. The acreage planted to alfalfa and corn was higher than that in the period 1957 to 1967. The acreage planted to all other crops remained the same or was lower. The acreage that was summer fallowed increased by 13 percent. Most of the acreage used for corn is irrigated.

The following paragraphs describe the management needed on the cropland in the county. The concerns of management are water erosion, soil blowing, drainage, and tilth.

Water erosion is a major concern on about 55 percent of the cropland. Loss of the surface layer through erosion reduces the productivity of soils and results in the pollution of streams. Productivity is reduced as the surface layer is lost and part of the subsoil is mixed into a plow layer. It is especially reduced in soils that have a clayey subsoil, such as Harney soils. The sediment from eroded soils can enter nearby streams. Measures that control water erosion also help to prevent the pollution of streams.

Measures that control erosion provide a protective plant cover, reduce the runoff rate, and increase the infiltration rate. A cropping system that keeps a plant cover on the soil for extended periods helps to control erosion and preserves the productive capacity of the soils.

Terraces and diversions reduce the length of slopes, the runoff rate, and the risk of erosion. They are most practical on deep, well drained soils that have uniform, regular slopes. Nearly all of the soils in the county are examples of such soils.

Contour farming should generally be used in combination with terraces. It is best suited to those soils that have smooth, uniform slopes and are suitable for terracing.

Leaving crop residue on the surface by minimizing tillage increases the infiltration rate and reduces the runoff rate and the risk of erosion. This measure is especially desirable on Pratt, Attica, and Naron soils, which cannot be farmed on the contour or terraced because they have short, irregular slopes.

Soil blowing is a concern in managing the soils throughout the county. It can damage soils in a few hours if winds are strong and the soils are dry and the surface bare. Maintaining a plant cover, returning crop residue to the soil, and planting windbreaks of suitable trees and shrubs are effective in controlling soil blowing. Roughening a bare surface helps to control soil blowing in an emergency.

A drainage system is a minor management need on a small acreage of cropland in the county. A surface drainage system is needed, for example, on Carwile soils and Drummond soils.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth generally have granular structure and are somewhat porous.

In the areas north of the Arkansas River, most of the soils used as cropland have a dark surface layer of silt loam or loam. The organic matter content is moderate. Generally, the structure of the surface layer is weak or moderate granular and the impact of rainfall on the unprotected surface results in the formation of a crust. The crust is hard when dry. It reduces the infiltration rate and increases the runoff rate and the susceptibility to soil blowing. Regular additions of crop residue, manure, and other organic material improve the soil structure, help to prevent crusting, and help to control soil blowing. The natural structure of New Cambria and Ness soils can be destroyed if the soils are tilled when too wet or too dry. Most of the other soils in the county can be tilled throughout a wide range of moisture content.

Information about the measures that control erosion is available in the local office of the Soil Conservation Service. The latest information about growing crops can be obtained from the local office of the Cooperative Extension Service or the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

H. Lynn Gibson, range conservationist, Soil Conservation Service, helped prepare this section.

About 98,000 acres in Barton County, or 19 percent of the total acreage, is rangeland. Most of the rangeland occurs as areas of shallow or moderately deep, limy soils on uplands adjacent to the valley of the Arkansas River and its tributaries. Smaller areas are throughout the county. They are dominantly areas of Tivoli and other sandy soils.

Most of the ranches are cow-calf enterprises, but some are steer-yearling enterprises. The range grasses are the major source of forage, but they generally are supplemented by crop stubble and other forage on cropland. In winter they commonly are supplemented by hay and by protein concentrates.

Soils strongly influence the natural vegetation. The deep, moderately deep, and shallow soils in the northern part of the county support a mixture of short, mid, and tall grasses. The deep soils in the southern part of the county, including the valley of the Arkansas River, can support a plant community that is dominated by tall grasses.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for most soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about

the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The native vegetation in most parts of the county has been depleted by continued excessive use, especially on the Saline Lowland and Subirrigated range sites, which could be highly productive. Forage production on these sites is generally less than one-half of the potential. Brush invasion is a problem on most of these sites.

windbreaks and environmental plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Only a small acreage in Barton County is native woodland. Wooded areas are along the Arkansas River and other major streams and the upland drainageways. Eastern cottonwood, black willow, and Siberian elm are the most common species along the Arkansas River and other major streams. Black locust and northern catalpa were planted on 1- to 10-acre tracts, mainly on the Pratt-Tivoli and Pratt-Carwile associations, which are described under the heading "General soil map units." They are used for the production of fenceposts.

On many farmsteads and ranch headquarters, landowners have planted windbreaks at various times. Siberian elm, eastern redcedar, and eastern cottonwood are the most numerous trees in these windbreaks and in the field windbreaks or shelterbelts. Other common trees are black locust, honeylocust, green ash, and common hackberry. Tree planting around farmsteads or ranch headquarters is a continual need because old trees deteriorate after they pass maturity, because some trees die as a result of insects or disease, and because new windbreaks are needed in areas where farming or ranching is expanding.

Field windbreaks or shelterbelts are numerous in the southern part of the county. They are planted on the sandy soils in the Naron-Farnum, Pratt-Carwile, and Pratt-Tivoli associations. Only a few shelterbelts are planted on the Harney-Crete, Wakeen-Nibson, and Drummond-Tabler associations, which are dominantly north of the Arkansas River. Many of the shelterbelts, especially the older ones, consist of eight to ten rows of trees and shrubs. The most common shrubs are Russian-olive, American plum, and lilac. Many of the older shelterbelts support an undergrowth of eastern redcedar, which has invaded. Also, many support green ash and black locust sprouts.

Most of the soils in the county are suitable for windbreaks and environmental plantings (fig. 14). The main limitation affecting the trees and shrubs before and after they are established are an inadequate amount or poor distribution of rainfall, and the main hazards are soil blowing and erosion. As a result of these problems, special care is needed in selecting the trees and shrubs that are best suited to the soil on the site, in preparing the site, and in controlling the plants that compete with the trees and shrubs for moisture. A shallow root zone, a low available water capacity, low natural fertility, and a high content of salts seriously restrict growth rates and the height that the trees and shrubs can reach. As a result, Drummond, Hedville, and Platte soils are poorly suited to trees and shrubs.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Several features enhance the potential of Barton County for recreational uses. The Cheyenne Bottoms Wildlife Area, northeast of Great Bend, attracts thousands of duck and goose hunters each hunting season. Throughout the year birdwatchers and wildlife photographers observe or photograph the many species that visit these wetlands. Farm ponds and the Arkansas

Figure 14.—Trees planted on Naron fine sandy loam, 0 to 3 percent slopes.

River and its tributaries provide opportunities for water sports. The potential for additional recreational development within the county is fair.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Barton County are the ringneck pheasant, bobwhite quail, mourning dove, cottontail rabbit, and white-tailed deer. During the migratory seasons, many species of waterfowl are hunted and observed on the wetlands on the Cheyenne Bottoms.

Nongame species are numerous because of the many habitat types in the county. Cropland, woodland, and grassland are interspersed throughout the county. Each of these habitat types provides a habitat for a particular group of species.

Furbearers are sparse to common along the Arkansas River and its tributaries. They are trapped on a limited basis.

Stock water ponds and the streams in the county provide good to excellent fishing. The species commonly caught are largemouth bass, bluegill, carp and channel cat, bullhead, and flathead catfish.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, grain sorghum, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are gamagrass, switchgrass, bluestems, indiangrass, goldenrod, ragweed, wheatgrass, and native legumes.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of native shrubs are plum, dogwood, buckbrush, prairie rose, and sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites.

Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, indigobush, prairie cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, mourning dove, pheasant, meadowlark, field sparrow, and cottontail rabbit.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, redwing blackbirds, muskrat, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include prairie dogs, badger, jackrabbits, mule deer, hawks, killdeer, and meadowlark.

Technical assistance in planning wildlife areas and in determining vegetation suitable for planting can be obtained from the local office of the Soil Conservation Service. Additional information and assistance can be obtained from local offices of the Kansas Fish and Game Commission and the Cooperative Extension Service.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to

overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the

lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed

channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil

blowing in cultivated areas. The groups indicate the susceptibility to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than

that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations generally can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiaquolls (*Argi*, meaning argillic horizon, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argiaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, thermic Typic Argiaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*5*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Attica series

The Attica series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy and sandy eolian deposits. Slope ranges from 1 to 4 percent.

Attica soils are similar to Naron and Pratt soils and are commonly adjacent to those soils and to Carwile soils. The somewhat poorly drained Carwile soils are in depressions. They have a clayey subsoil. Naron soils are on the lower slopes. Their subsoil is more clayey than that of the Attica soils. Pratt soils are more sandy than the Attica soils. They are on the higher ridges.

Typical pedon of Attica loamy fine sand, 1 to 4 percent slopes, 1,815 feet west and 100 feet south of the northeast corner of sec. 10, T. 20 S., R. 13 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; medium acid; clear smooth boundary.
A12—8 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; few fine roots; medium acid; clear smooth boundary.
B2t—12 to 20 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; slightly acid; gradual smooth boundary.
B3—20 to 36 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; few fine roots; neutral; gradual smooth boundary.
C—36 to 60 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grained; loose; neutral.

The thickness of the solum ranges from 28 to 50 inches. The depth to lime is more than 30 inches.

The A horizon has hue of 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2. It is medium acid to neutral. It is dominantly loamy fine sand, but the range includes fine sandy loam. The B2 horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is medium acid or slightly acid. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. It is loamy fine sand or fine sandy loam. It is slightly acid to mildly alkaline. Silty or more clayey strata are below a depth of 40 inches in some pedons.

Bridgeport series

The Bridgeport series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in calcareous, silty alluvial sediments. Slope ranges from 0 to 2 percent.

Bridgeport soils are similar to Hord and Roxbury soils and are commonly adjacent to Hord and New Cambria soils. Hord soils are dark to a depth of 20 to 40 inches and do not have free lime in the upper part. They are in positions on the landscape similar to those of the Bridgeport soils. New Cambria soils have a clayey subsoil. They are slightly lower on the landscape than the Bridgeport soils. The occasionally flooded Roxbury soils are on narrow flood plains along upland drainageways.

Typical pedon of Bridgeport silt loam, 1,650 feet west and 100 feet south of the northeast corner of sec. 22, T. 19 S., R. 13 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slight effervescence; moderately alkaline; clear smooth boundary.
A12—5 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.
B2—10 to 18 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.
C—18 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few fine roots; many fine pores; thin, darker, loamy and more clayey strata; common threads and films of lime; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 30 inches. Lime is commonly at the surface, and reaction is mildly alkaline or moderately alkaline throughout the profile. Thin, more sandy or more clayey strata that vary in color are below a depth of 20 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silt loam or silty clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is silt loam or loam.

Canadian series

The Canadian series consists of deep, well drained, moderately rapidly permeable soils on terraces. These soils formed in loamy alluvial sediments. Slope ranges from 0 to 2 percent.

Canadian soils are similar to Kaski soils and are commonly adjacent to Hord, Kaski, Waldeck, and Zenda soils. Kaski soils have a subsoil that is more clayey than that of the Canadian soils. They are in positions on the landscape similar to those of the Canadian soils. Hord soils are less sandy throughout than the Canadian soils. Also, they are in slightly lower areas. Waldeck and Zenda soils are somewhat poorly drained and are on flood plains.

Typical pedon of Canadian fine sandy loam, 750 feet east and 2,350 feet north of the southwest corner of sec. 10, T. 20 S., R. 14 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A12—7 to 14 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary.

B2—14 to 32 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; mildly alkaline; gradual smooth boundary.

C—32 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; few threads and soft white accumulations of carbonate; about 5 percent gravel; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. It is fine sandy loam, sandy loam, or loam. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is medium acid to neutral. The B2 horizon has hue of 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is slightly acid to mildly alkaline. The C horizon has hue of 10YR, value of 5 to 7 (3 to 6 moist), and chroma of 3 to 6. It is fine sandy loam or sandy loam and has thin layers of loamy fine sand below a depth of 40 inches. It ranges from slightly acid to moderately alkaline.

Carwile series

The Carwile series consists of deep, somewhat poorly drained, slowly permeable soils that formed in old alluvium on broad, slightly depressional uplands. Slope is 0 to 1 percent.

Carwile soils are similar to Tabler soils and are commonly adjacent to Attica, Farnum, Naron, and Pratt soils. Tabler soils are dark to a depth of 20 to 36 inches. They are on the slightly higher flats. Attica, Farnum, Naron, and Pratt soils are more sandy in the subsoil than the Carwile soils. They do not have mottles in the upper part of the subsoil. They are well drained and are on side slopes and ridges.

Typical pedon of Carwile fine sandy loam, 495 feet north and 100 feet east of the southwest corner of sec. 13, T. 20 S., R. 13 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; medium acid; clear smooth boundary.

B1—10 to 18 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

B2t—18 to 32 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common medium distinct strong brown (7.5YR 5/6) mottles; strong medium blocky structure; very hard, very firm; few fine roots; neutral; gradual smooth boundary.

B3—32 to 46 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; many medium distinct strong brown (7.5YR 5/6) mottles; weak medium blocky structure; very hard, firm; few fine roots; neutral; gradual smooth boundary.

C—46 to 60 inches; light gray (10YR 6/1) clay, gray (10YR 5/1) moist; many fine distinct reddish yellow (7.5YR 6/6) mottles; massive; very hard, very firm; few soft white accumulations of carbonate; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is medium acid or slightly acid. It is dominantly fine sandy loam, but the range includes loamy fine sand. The B2 horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2. It is clay or clay loam. It has common to many, fine to medium, distinct reddish mottles and some grayish mottles. The C horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 4. It is clay, sandy clay loam, or clay loam.

Crete series

The Crete series consists of deep, moderately well drained, slowly permeable soils formed in loess on uplands. Slope ranges from 0 to 2 percent.

Crete soils are similar to Harney soils and are commonly adjacent to Geary, Harney, and Tabler soils. Harney soils are not dark to so great a depth as the Crete soils. Also, they are shallower to soft accumulations of lime. They are on the lower side slopes. Geary soils also are on the lower side slopes. Their subsoil is less clayey than that of the Crete soils. Tabler soils are more clayey in the upper part of the subsoil than the Crete soils. They are in slight depressions.

Typical pedon of Crete silt loam, 1,545 feet south and 150 feet west of the northeast corner of sec. 25, T. 19 S., R. 12 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; abrupt smooth boundary.

A12—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; slightly acid; clear smooth boundary.

B1—11 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2)

moist; moderate medium granular structure; hard, firm; common fine roots; slightly acid; gradual smooth boundary.

B21t—16 to 24 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; neutral; gradual smooth boundary.

B22t—24 to 33 inches; brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; strong medium blocky structure; very hard, very firm; neutral; gradual smooth boundary.

B3—33 to 47 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; very hard, very firm; many soft white accumulations of carbonate; slight effervescence; mildly alkaline; gradual smooth boundary.

C—47 to 60 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; massive; hard, friable; few soft white accumulations of carbonate; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to lime ranges from 25 to 40 inches and the thickness of the mollic epipedon from 20 to 36 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is medium acid or slightly acid. It is dominantly silt loam, but the range includes silty clay loam. The B1 horizon is similar in color to the A horizon. The B2 horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is slightly acid or neutral. The C horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Dillwyn series

The Dillwyn series consists of deep, somewhat poorly drained, rapidly permeable soils formed in sandy eolian sediments on terraces and flats in the sandhills. Slope ranges from 0 to 2 percent.

Dillwyn soils are similar to Platte soils and are commonly adjacent to Pratt, Tivoli, and Waldeck soils. Platte soils are coarser textured in the C horizon than the Dillwyn soils. They are on flood plains. The well drained Pratt soils are in the higher undulating or rolling areas. Their subsoil is more clayey than that of the Dillwyn soils. The excessively drained Tivoli soils are in the higher rolling or hilly areas. They are not mottled. Waldeck soils are more clayey than the Dillwyn soils. They are on the lower flood plains.

Typical pedon of Dillwyn loamy fine sand, in an area of Dillwyn-Tivoli complex, 0 to 15 percent slopes, 650 feet east and 150 feet north of the southwest corner of sec. 36, T. 20 S., R. 11 W.

A1—0 to 8 inches; brown (10YR 5/3) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; many fine roots; slightly acid; gradual smooth boundary.

AC—8 to 30 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; common medium distinct reddish yellow (7.5YR 6/6) mottles; weak coarse granular structure; soft, very friable; common fine roots; slightly acid; gradual smooth boundary.

C1—30 to 48 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; common medium distinct reddish yellow (7.5YR 7/6) mottles; massive; soft, very friable; common fine roots; slightly acid; gradual smooth boundary.

C2—48 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; many medium distinct reddish yellow (7.5YR 6/6) mottles; massive; slightly acid.

The thickness of the solum ranges from about 14 to 35 inches. The upper 40 inches contains no lime.

The A horizon has hue of 10YR, value of 3 to 5 (2 to 4 moist), and chroma of 2 or 3. It is slightly acid or neutral. It is dominantly loamy fine sand, but the range includes fine sand. The AC horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It has common, fine to medium, faint or distinct mottles with higher chroma and redder hue than the matrix. It is loamy fine sand or fine sand. It is slightly acid or neutral. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 or 4. It is dominantly loamy fine sand, fine sand, or fine sandy loam, but it has layers of loam or clay loam below a depth of 40 inches in a few pedons. It ranges from medium acid to mildly alkaline.

Drummond series

The Drummond series consists of deep, somewhat poorly drained, very slowly permeable soils formed in calcareous old alluvium on old lakebeds and terraces. Slope is 0 to 1 percent.

Drummond soils are adjacent to Hord, Naron, and Tabler soils. None of the adjacent soils have a natric horizon. Hord and Naron soils have a subsoil that is less clayey than that of the Drummond soils. Hord soils are in the slightly higher areas, and Naron soils are in the higher undulating areas. Tabler soils are dark to a depth of 20 to 36 inches. They are on the slightly higher flats.

Typical pedon of Drummond silt loam, 2,310 feet south and 200 feet east of the northwest corner of sec. 2, T. 18 S., R. 13 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; common fine roots; the upper one-half inch is crusted and vesicular; moderately alkaline; clear wavy boundary.

B21t—8 to 15 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure; very hard, very firm; few fine roots; strong effervescence; many fine and medium masses of salts; strongly alkaline; gradual smooth boundary.
B22t—15 to 30 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; common fine faint light yellowish brown (10YR 6/4) mottles; moderate medium blocky structure; very hard, very firm; few fine roots; strong effervescence; many fine and medium masses of gypsum and few fine lime concretions; strongly alkaline; diffuse smooth boundary.
C—30 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; common fine faint light yellowish brown (10YR 6/4) and few medium faint light gray (10YR 7/2) mottles; massive; hard, firm; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 60 inches. The thickness of the A horizon ranges from 4 to 10 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It ranges from slightly acid to moderately alkaline. It is dominantly silt loam, but the range includes loam. The B2 horizon has hue of 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 1 or 2. It is clay, clay loam, or silty clay loam. It ranges from mildly alkaline to strongly alkaline. The content of exchangeable sodium is more than 15 percent in some part of this horizon. The electrical conductivity of the saturation extract in the B and C horizons ranges from 4 to 16 millimhos per centimeter in most pedons. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is dominantly silty clay loam or silty clay, but it has thin strata of loam and fine sandy loam below a depth of 40 inches. It is moderately alkaline or strongly alkaline.

Farnum series

The Farnum series consists of deep, well drained, moderately permeable soils formed in loamy old alluvium on uplands. Slope ranges from 0 to 2 percent.

Farnum soils are similar to Naron soils and are commonly adjacent to Carwile, Crete, Naron, and Tabler soils. Naron soils have a mollic epipedon that is less than 20 inches thick and have a subsoil that is less clayey than that of the Farnum soils. They are on the higher ridges and side slopes. Carwile, Crete, and Tabler soils have a clayey subsoil. The somewhat poorly drained Carwile soils and the moderately well drained Tabler soils are in depressions. The moderately well drained Crete soils are on the lower slopes.

Typical pedon of Farnum loam, 495 feet east and 120 feet south of the northwest corner of sec. 1, T. 19 S., R. 12 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; medium acid; clear smooth boundary.
A12—8 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.
B1—14 to 26 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; common fine roots; neutral; clear smooth boundary.
B21t—26 to 36 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium blocky structure; hard, firm; common fine roots; neutral; gradual smooth boundary.
B22t—36 to 42 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; few fine faint strong brown (7.5YR 5/6) mottles; weak fine blocky structure; hard, firm; few fine roots; mildly alkaline; gradual smooth boundary.
C—42 to 60 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; common fine distinct reddish yellow (7.5YR 6/6) mottles; massive; hard, friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to more than 70 inches. The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. It is medium acid to neutral. It is dominantly loam, but the range includes fine sandy loam. The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is clay loam or sandy clay loam. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. It is clay loam, fine sandy loam, or loam. It is neutral to moderately alkaline.

Geary series

The Geary series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in reddish silty loess. Slope ranges from 1 to 7 percent.

Geary soils are similar to Holdrege soils and are commonly adjacent to Crete and Harney soils. Holdrege soils are less red in the lower part of the subsoil and in the substratum than the Geary soils. They are on the upper side slopes. Crete and Harney soils are on the upper side slopes and on ridgetops. Their subsoil is more clayey than that of the Geary soils.

Typical pedon of Geary silt loam, 1 to 3 percent slopes, 1,980 feet north and 100 feet east of the southwest corner of sec. 24, T. 18 S., R. 11 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable;

many fine roots; medium acid; abrupt smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; slightly acid; gradual smooth boundary.

B1—12 to 18 inches; brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/3) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; slightly acid; gradual smooth boundary.

B2t—18 to 33 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; slightly acid; gradual smooth boundary.

B3—33 to 42 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, firm; neutral; diffuse smooth boundary.

C—42 to 60 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; massive; hard, friable; mildly alkaline.

The thickness of the solum ranges from 30 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is slightly acid or medium acid. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 7.5YR or 5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 or 4. It is slightly acid or neutral. The C horizon has hue of 7.5YR or 5YR, value of 5 to 7 (4 or 5 moist), and chroma of 4 to 6. It is clay loam or silty clay loam. It is neutral or mildly alkaline.

Harney series

The Harney series consists of deep, well drained, moderately slowly permeable soils formed in calcareous loess on uplands. Slope ranges from 1 to 4 percent.

Harney soils are similar to Crete soils and are commonly adjacent to Crete, Holdrege, Nibson, Uly, and Wakeen soils. The moderately well drained Crete soils are on flats above the Harney soils. Their mollic epipedon is thicker than that of the Harney soils. Holdrege soils are on ridges and side slopes above the Harney soils. Their subsoil is less clayey than that of the Harney soils. The somewhat excessively drained Nibson soils generally are steeper than the Harney soils and are on the lower side slopes. They have chalky limestone at a depth of 10 to 20 inches. Uly soils are on the lower side slopes. Their subsoil is less clayey than that of the Harney soils. Wakeen soils have chalky limestone and shale at a depth of 20 to 40 inches. They generally are steeper than the Harney soils and are on the lower side slopes.

Typical pedon of Harney silt loam, 1 to 4 percent slopes, 1,500 feet north and 100 feet east of the southwest corner of sec. 22, T. 16 S., R. 14 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; abrupt smooth boundary.

A3—5 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, friable; many fine roots; neutral; clear smooth boundary.

B21t—9 to 19 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine blocky; very hard, very firm; common fine roots; mildly alkaline; gradual smooth boundary.

B22tca—19 to 31 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine blocky; hard, firm; few fine roots; few fine lime concretions; strong effervescence; moderately alkaline; gradual smooth boundary.

B3ca—31 to 39 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; common fine faint brownish yellow (10YR 6/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm; common fine lime concretions and soft masses of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

Cca—39 to 60 inches; light gray (10YR 7/2) silty clay loam, light brownish gray (10YR 6/2) moist; common fine distinct reddish yellow (7.5YR 7/6) mottles; massive; slightly hard, friable; common fine lime concretions and soft masses of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 60 inches. The depth to free carbonates ranges from 18 to 30 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is slightly acid or neutral. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is silty clay loam or silty clay. It ranges from slightly acid to moderately alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silt loam or silty clay loam and is mildly alkaline or moderately alkaline.

Hedville series

The Hedville series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in material weathered from noncalcareous sandstone. Slope ranges from 3 to 15 percent.

Hedville soils are similar to Nibson soils and are commonly adjacent to Crete, Geary, Lancaster, Nibson, and Wakeen soils. Nibson soils have chalky limestone at a depth of 10 to 20 inches. They are on the upper side slopes. The deep Crete and Geary soils are on broad ridgetops and the upper side slopes. Their subsoil is more clayey than that of the Hedville soils. The moderately deep, well drained Lancaster soils are on the upper slopes and on foot slopes. Wakeen soils have chalky limestone at a depth of 20 to 40 inches. They are on the upper side slopes.

Typical pedon of Hedville fine sandy loam, in an area of Lancaster-Hedville complex, 3 to 15 percent slopes, 2,310 feet west and 150 feet north of the southeast corner of sec. 34, T. 17 S., R. 13 W.

A11—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; about 5 percent angular sandstone fragments; slightly acid; gradual wavy boundary.

A12—10 to 16 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; about 15 percent angular sandstone fragments 1/2 inch to 3 inches in diameter; medium acid; clear irregular boundary.

R—16 inches; brown sandstone.

The thickness of the solum and the depth to sandstone range from 4 to 20 inches. Reaction ranges from medium acid to neutral.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes loam, stony loam, and stony sandy loam. The content of coarse fragments is less than 35 percent. Some pedons have a C horizon between the mollic epipedon and the bedrock. This horizon has properties that generally are like those of the A horizon, but it has hue of 10YR or 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4.

Holdrege series

The Holdrege series consists of deep, well drained, moderately permeable soils formed in loess on uplands. Slope ranges from 1 to 3 percent.

Holdrege soils are similar to Geary soils and are commonly adjacent to Crete, Harney, and Uly soils. Geary soils are more red in the subsoil and substratum than the Holdrege soils and are deeper to lime. They are on the lower side slopes and along drainageways. Crete and Harney soils are lower on the landscape than the Holdrege soils. Also, their subsoil is more clayey. Uly soils are on the lower side slopes. Their subsoil is less clayey than that of the Holdrege soils.

Typical pedon of Holdrege silt loam, 1 to 3 percent slopes, 960 feet east and 100 feet south of the northwest corner of sec. 22, T. 19 S., R. 12 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; slightly acid; clear smooth boundary.

B21t—13 to 18 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, firm; common fine roots; neutral; gradual smooth boundary.

B22t—18 to 26 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; neutral; gradual smooth boundary.

B3—26 to 35 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable; mildly alkaline; gradual smooth boundary.

C—35 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; few fine lime concretions; slight effervescence; moderately alkaline.

The thickness of the solum and depth to lime range from 24 to 36 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is neutral or slightly acid. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is silty clay loam in which the content of clay ranges from 28 to 35 percent. It is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Hord series

The Hord series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in silty alluvium. Slope ranges from 0 to 2 percent.

Hord soils are similar to Bridgeport and Roxbury soils and are commonly adjacent to Kaski, New Cambria, and Tabler soils. Bridgeport soils are dark to a depth of less than 20 inches and have lime within a depth of 15 inches. They are on terraces adjacent to streams. Roxbury soils have lime within a depth of 15 inches. They are on flood plains along upland drainageways that are occasionally flooded. Kaski soils are in positions on

the landscape similar to those of the Hord soils. Their subsoil is more sandy than that of the Hord soils. New Cambria soils are more clayey than the Hord soils. They are in low areas. Tabler soils are on uplands. Their subsoil is more clayey than that of the Hord soils.

Typical pedon of Hord silt loam, 675 feet south and 100 feet west of the northeast corner of sec. 21, T. 19 S., R. 14 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

B2—12 to 26 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; few fine roots; neutral; gradual smooth boundary.

B3—26 to 39 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium granular structure; slightly hard, friable; few fine roots; mildly alkaline; gradual smooth boundary.

C—39 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; common fine soft accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 32 to 55 inches. The depth to lime ranges from 30 to 48 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is slightly acid or neutral. It is dominantly silt loam, but the range includes silty clay loam and loam. The B2 horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It is silt loam or silty clay loam. It is neutral or slightly acid. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 3. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Kaski series

The Kaski series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in loamy alluvium. Slope ranges from 0 to 2 percent.

Kaski soils are similar to Canadian soils and are commonly adjacent to Canadian, Hord, Platte, Waldeck, and Zenda soils. Canadian soils are sandier than the Kaski soils. They are on the higher ridges. Hord soils are less sandy than the Kaski soils. They are on terraces, some of which are slightly higher than the terraces occupied by Kaski soils. The somewhat poorly drained Platte soils are sandy and are on flood plains. Waldeck soils are less clayey than the Kaski soils. They are on flood plains. The somewhat poorly drained Zenda soils are on the slightly lower flood plains. They are dark to a depth of 10 to 20 inches.

Typical pedon of Kaski loam, 3,960 feet south and 1,200 feet east of the northwest corner of sec. 34, T. 19 S., R. 12 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.

A12—10 to 23 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; neutral; gradual smooth boundary.

AC—23 to 34 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; few soft white accumulations of lime; slight effervescence; mildly alkaline; gradual smooth boundary.

C—34 to 60 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; common fine faint brownish yellow (10YR 6/6) mottles; massive; slightly hard, friable; few fine roots; common soft white accumulations of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to lime ranges from 15 to 36 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is slightly acid or neutral. It is dominantly loam, but the range includes fine sandy loam and clay loam. The AC horizon has hue of 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 1 to 3. It is loam or clay loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is sandy loam, loam, or clay loam. Some pedons have sandy strata below a depth of 40 inches.

Lancaster series

The Lancaster series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from noncalcareous sandstone and sandy shale. Slope ranges from 3 to 12 percent.

Lancaster soils are similar to Naron soils and are commonly adjacent to Geary, Harney, and Hedville soils.

The deep Naron soils formed in loamy eolian deposits. The deep Geary and Harney soils are on the upper side slopes and on ridgetops. Their subsoil is more clayey than that of the Lancaster soil. The shallow Hedville soils are on the steeper side slopes.

Typical pedon of Lancaster loam, in an area of Lancaster-Hedville complex, 3 to 15 percent slopes, 2,100 feet south and 300 feet west of the northeast corner of sec. 33, T. 18 S., R. 13 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; hard, friable; many fine roots; about 4 percent rounded sandstone fragments 1/4 inch to 2 inches in diameter; medium acid; clear smooth boundary.

B1—8 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; about 5 percent rounded sandstone fragments 1/4 inch to 2 inches in diameter; medium acid; gradual smooth boundary.

B2t—14 to 26 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; common fine roots; about 5 percent rounded sandstone fragments 1/4 inch to 2 inches in diameter; slightly acid; gradual smooth boundary.

B3—26 to 34 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; about 10 percent rounded sandstone fragments 1 to 3 inches in diameter; neutral; gradual wavy boundary.

Cr—34 inches; weathered sandy shale.

The thickness of the solum ranges from 20 to 40 inches and coincides with the depth to sandstone or shale. Fine fragments of sandstone are throughout the solum, but the content of these fragments is not as high as 35 percent, by volume, in any horizon.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is medium acid or slightly acid. It is dominantly loam, but the range includes sandy loam. The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 6. It is clay loam or sandy clay loam. It is slightly acid or neutral.

Naron series

The Naron series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy eolian deposits. Slope ranges from 0 to 3 percent.

Naron soils are similar to Attica, Farnum, and Lancaster soils and are commonly adjacent to Attica, Carwile, Farnum, and Pratt soils. Attica and Pratt soils are on the higher ridges and side slopes. Their subsoil is more sandy than that of the Naron soils. The somewhat poorly drained Carwile soils are in depressions. They have a clayey subsoil. Farnum soils are lower on the landscape than the Naron soils. They are dark to a greater depth than the Naron soils. Lancaster soils have shale and sandstone at a depth of 20 to 40 inches. They are on the lower side slopes.

Typical pedon of Naron fine sandy loam, 0 to 3 percent slopes, 660 feet east and 100 feet south of the northwest corner of sec. 17, T. 20 S., R. 13 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, friable; many fine roots; medium acid; clear smooth boundary.

B1—7 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; slightly acid; gradual smooth boundary.

B2t—12 to 36 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable; common fine roots; neutral; gradual smooth boundary.

B3—36 to 44 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; neutral; gradual smooth boundary.

C—44 to 60 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; massive; soft, very friable; mildly alkaline.

The thickness of the solum ranges from 36 to 60 inches. The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. It is medium acid to neutral. It is dominantly fine sandy loam, but the range includes loam and loamy fine sand. The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is sandy clay loam or fine sandy loam. It is medium acid to mildly alkaline. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. It is fine sandy loam or loamy fine sand. It is slightly acid to moderately alkaline.

Ness series

The Ness series consists of deep, poorly drained, very slowly permeable soils in shallow depressions. These soils formed in clayey alluvium and eolian sediments. Slope is mainly less than 1 percent.

Ness soils are commonly adjacent to Crete and Tabler soils. These moderately well drained adjacent soils are on the slightly higher flats and side slopes. They have an argillic horizon.

Typical pedon of Ness silty clay, 1,800 feet east and 900 feet south of the northwest corner of sec. 29, T. 19 S., R. 11 W.

A11—0 to 10 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate fine blocky structure; very hard, very firm; many fine roots; neutral; gradual smooth boundary.

A12—10 to 30 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak medium blocky structure; very hard, very firm; few slickenside faces on large peds; common fine roots; mildly alkaline; clear smooth boundary.

C—30 to 60 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; few fine roots; common soft white accumulations of lime and lime films and few fine lime concretions; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 48 inches. The depth to lime ranges from 24 to 40 inches.

The A horizon has hue of 10YR, value 4 or 5 (2 or 3 moist), and chroma of 1. It is neutral to moderately alkaline. It is dominantly silty clay, but the range includes clay. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is dominantly silty clay or silty clay loam. In some pedons, however, it is silt loam below a depth of about 42 inches. It commonly contains lime throughout and is mildly alkaline or moderately alkaline.

New Cambria series

The New Cambria series consists of deep, moderately well drained, slowly permeable soils formed in calcareous, clayey alluvium on terraces along the larger streams. Slope is 0 to 1 percent.

New Cambria soils are commonly adjacent to Bridgeport, Hord, and Kaski soils. Bridgeport soils are less clayey than the New Cambria soils. They are on the higher streambanks. The well drained Hord soils are on the slightly higher terraces. They are less clayey than the New Cambria soils. Kaski soils are more sandy than the New Cambria soils. They are on the slightly higher terraces.

Typical pedon of New Cambria silty clay loam, 1,620 feet west and 200 feet north of the southeast corner of sec. 4, T. 19 S., R. 14 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, firm; many fine roots; slight effervescence; moderately alkaline; gradual smooth boundary.

A12—7 to 14 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, firm; many fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

B21—14 to 24 inches; dark grayish brown (10YR 4/2) silty clay, very dark brown (10YR 2/2) moist; moderate fine blocky structure; very hard, very firm; many fine roots; few films and threads of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

B22—24 to 31 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, very firm; few fine roots; many films and threads of lime and many small soft lime accumulations; strong effervescence; moderately alkaline; clear smooth boundary.

C—31 to 60 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; very hard, firm; many films and threads of lime; strong effervescence; moderately alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 25 to 40 inches. The depth to lime ranges from 0 to 15 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is neutral to moderately alkaline. It is dominantly silty clay loam, but the range includes silty clay and clay. The B2 horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay loam or silty clay. The C horizon has hue of 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 1 to 3. It is silty clay loam or silty clay.

Nibson series

The Nibson series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in material weathered from interbedded chalky shale and limestone. Slope ranges from 3 to 15 percent.

Nibson soils are similar to Hedville and Wakeen soils and are commonly adjacent to Harney and Wakeen soils. Hedville soils are noncalcareous. They are on the lower side slopes. Wakeen soils have chalky limestone at a depth of 20 to 40 inches. They are on the upper side slopes and on foot slopes. Harney soils are on ridgetops and side slopes above the Nibson soils. Their subsoil is more clayey than that of the Nibson soils.

Typical pedon of Nibson silt loam, in an area of Nibson-Wakeen silt loams, 3 to 15 percent slopes, 100 feet north and 50 feet east of the southwest corner of sec. 3, T. 18 S., R. 14 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; about 2 percent small limestone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

B2—8 to 14 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; moderate medium granular structure; slightly hard, friable; few fine roots; about 3 percent small limestone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

C—14 to 19 inches; very pale brown (10YR 8/3) silt loam, very pale brown (10YR 7/4) moist; weak medium granular structure; about 10 percent limestone and shale fragments; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—19 inches; interbedded chalky shale and soft limestone.

The thickness of the solum ranges from 10 to 15 inches. The depth to chalky shale and limestone ranges from 10 to 20 inches (fig. 15). The thickness of the mollic epipedon ranges from 7 to 10 inches.

Figure 15.—Typical profile of Nibson silt loam. Interbedded chalky shale and limestone are at a depth of about 12 to 15 inches. Depth is marked in feet.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is mildly alkaline to strongly alkaline. It is dominantly silt loam, but the range includes loam. The B2 horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silty clay loam or silt loam. It is moderately alkaline or strongly alkaline. The C horizon has hue of 10YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is moderately alkaline or strongly alkaline.

Platte series

The Platte series consists of deep, somewhat poorly drained, very rapidly permeable soils formed in loamy and sandy alluvium on flood plains. Slope is 0 to 1 percent.

The Platte soils in Barton County are taxadjuncts to the Platte series because they lack the low-chroma matrix colors and the fine stratification that are characteristic of Fluvaquents. These differences, however, do not alter the use or behavior of the soils.

Platte soils are similar to Dillwyn soils and are commonly adjacent to Kaski, Waldeck, and Zenda soils. Dillwyn soils do not have sand in the substratum. They are on terraces. Kaski soils also are on terraces. They are dark to a depth of 20 to 40 inches. Waldeck soils have a subsoil that is more loamy than that of the Platte soils. Also, they are slightly higher on the flood plains. Zenda also are slightly higher on the flood plains. Their subsoil is more clayey than that of the Platte soils.

Typical pedon of Platte fine sandy loam, 1,350 feet west and 120 feet north of the southeast corner of sec. 32, T. 19 S., R. 12 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—9 to 16 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; few fine faint grayish brown (10YR 5/2) and common fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; few fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

IIC2—16 to 60 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; common medium distinct brownish yellow (10YR 6/8) mottles; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 5 to 12 inches. The depth to sand ranges from 12 to 20 inches.

Mottles are at a depth of about 6 to 15 inches. They commonly are brown, but some are gray. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam, loamy fine sand, and clay loam. The C1 horizon has hue of 10YR, value of 6 or 7 (4 to 6 moist), and chroma of 2 or 3. It is loamy fine sand or sandy loam. The IIC horizon is dominantly sand, coarse sand, or fine gravel. In some pedons, however, it has thin strata of fine sand or gravelly sand.

Pratt series

The Pratt series consists of deep, well drained, rapidly permeable soils formed in sandy eolian deposits on uplands. Slope ranges from 1 to 12 percent.

Pratt soils are similar to Attica and Tivoli soils and are commonly adjacent to those soils and to Carwile and Naron soils. Attica soils are on the middle side slopes. Their subsoil is more clayey than that of the Pratt soils. The excessively drained Tivoli soils are on the higher ridgetops. Their subsoil is more sandy than that of the Pratt soils. The somewhat poorly drained Carwile soils are in depressions. Naron soils are on the lower side slopes. Their surface layer is darker than that of the Pratt soils, and their subsoil is more clayey.

Typical pedon of Pratt loamy fine sand, undulating, 2,240 feet south and 650 feet west of the northeast corner of sec. 19, T. 20 S., R. 11 W.

Ap—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose; many fine roots; medium acid; gradual smooth boundary.

A12—6 to 12 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; many fine roots; slightly acid; gradual smooth boundary.

B2t—12 to 28 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure; soft, very friable; several darker horizontal bands of clay-coated sand grains; common fine roots; medium acid; gradual smooth boundary.

C—28 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few fine roots; slightly acid.

The thickness of the solum ranges from 24 to 50 inches. The A horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is medium acid or slightly acid. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6 (4 or 5 moist), and chroma of 2 to 4. It is medium acid to neutral. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 to 6. It is slightly acid or neutral.

Roxbury series

The Roxbury series consists of deep, well drained, moderately permeable soils formed in calcareous, silty alluvium on flood plains. Slope ranges from 0 to 2 percent.

Roxbury soils are similar to Bridgeport and Hord soils and are commonly adjacent to those soils and to New Cambria soils. Bridgeport soils are on low terraces. They are dark to a depth of less than 20 inches. Hord soils have lime at a depth of more than 15 inches. They are on the slightly higher terraces. New Cambria soils are in depressions. Their subsoil is more clayey than that of the Roxbury soils.

Typical pedon of Roxbury silt loam, flooded, 1,980 feet west and 330 feet south of the northeast corner of sec. 30, T. 17 S., R. 13 W.

A1—0 to 20 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

B2—20 to 37 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—37 to 50 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few fine roots; many pores; films and fine threads of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—50 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; common fine faint light yellowish brown (10YR 6/4) mottles; massive; hard, friable; many soft white lime accumulations and few fine lime concretions; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 50 inches. The mollic epipedon ranges from 20 to 40 inches in thickness. The depth to lime is less than 15 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is neutral to moderately alkaline. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has colors similar to those of the A horizon. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. Some pedons have thin strata of slightly higher or lower value. The strata vary in thickness. They are silt loam, silty clay loam, and loam. In some pedons the texture is sandy or clayey below a depth of 40 inches.

Tabler series

The Tabler series consists of deep, moderately well drained, very slowly permeable soils formed in calcareous, silty and clayey alluvium in slight depressions on uplands. Slope is 0 to 1 percent.

Tabler soils are similar to Carwile soils and are commonly adjacent to Crete, Drummond, and Ness soils. Carwile soils are somewhat poorly drained and are in depressions. Crete soils are less clayey in the upper part of the subsoil than the Tabler soils. They are on the slightly higher flats. Drummond soils have excess salts and sodium in the subsoil. They are on the slightly lower flats. Ness soils are dominantly clayey throughout. They are in the lower depressions.

Typical pedon of Tabler silt loam, 990 feet north and 50 feet east of the southwest corner of sec. 35, T. 19 S., R. 11 W.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.

B21t—10 to 22 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate medium blocky structure; very hard, very firm; many fine roots; clay films on faces of peds; neutral; gradual smooth boundary.

B22t—22 to 30 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium blocky structure; very hard, very firm; few fine roots; thin clay films on faces of peds and in root channels; mildly alkaline; gradual smooth boundary.

B3—30 to 41 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; common fine faint gray (10YR 6/1) mottles; moderate medium blocky structure; very hard, very firm; few fine roots; few fine lime concretions; moderately alkaline; gradual smooth boundary.

C—41 to 60 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; common fine faint light gray (10YR 7/2) and light yellowish brown (10YR 6/4) mottles; massive; hard, firm; many fine soft masses of lime and many fine lime concretions; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 36 inches. Soft masses of lime are at a depth of 24 to 40 inches.

The A1 horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is medium acid to neutral. It is dominantly silt loam, but the range includes clay loam. The B horizon has hue of 10YR, value of 3 to 5 (2 to 4 moist), and chroma of 1 or 2. It is silty clay loam or silty clay. It is neutral to moderately alkaline. The C horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silty clay loam, clay, or clay loam. It is moderately alkaline or mildly alkaline. The mottles are few or common, fine or medium, and faint or distinct and are grayish or brownish.

Tivoli series

The Tivoli series consists of deep, excessively drained, rapidly permeable soils formed in sandy eolian deposits on hilly uplands. Slope ranges from 5 to 30 percent.

Tivoli soils are similar to Pratt soils and are commonly adjacent to Attica, Carwile, Dillwyn, and Pratt soils. The well drained Pratt and Attica soils have a subsoil that is more clayey than that of the Tivoli soils. Pratt soils are on middle side slopes, and Attica soils are on lower side slopes. The somewhat poorly drained Carwile soils are in depressions. They have a clayey subsoil. The somewhat poorly drained Dillwyn soils are mottled and are in depressions.

Typical pedon of Tivoli fine sand, hilly, 1,675 feet east and 150 feet south of the northwest corner of sec. 36, T. 20 S., R. 11 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many fine roots; slightly acid; gradual smooth boundary.

C—6 to 60 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; common fine roots; slightly acid.

The thickness of the solum ranges from 4 to 10 inches. The A horizon has hue of 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 2 to 4. It is slightly acid or neutral. It is dominantly fine sand, but the range includes loamy fine sand. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. It is slightly acid to mildly alkaline.

Uly series

The Uly series consists of deep, well drained, moderately permeable soils formed in calcareous loess on uplands. Slope ranges from 3 to 6 percent.

Uly soils are similar to Wakeen soils and are commonly adjacent to Harney soils. Wakeen soils have chalky limestone and shale at a depth of 20 to 40 inches. They are on the lower side slopes. Harney soils are on the upper side slopes and on ridgetops. Their subsoil is more clayey than that of the Uly soils.

Typical pedon of Uly silt loam, 3 to 6 percent slopes, 495 feet west and 120 feet north of the southeast corner of sec. 20, T. 19 S., R. 12 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

B1—6 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

B2—13 to 23 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; neutral; gradual smooth boundary.

B3—23 to 35 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; slight effervescence; few soft white accumulations of lime; moderately alkaline; gradual smooth boundary.

C—35 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable; few fine roots; many soft lime films and soft accumulations of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 12 to 36 inches. The depth to lime ranges from 8 to 25 inches (fig. 16). The thickness of the mollic epipedon ranges from 8 to 18 inches.

Figure 16.—Typical profile of Uly silt loam. The depth to lime is about 12 to 15 inches. Depth is marked in feet.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2. It is slightly acid to mildly alkaline. The B horizon has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 or 3. It is silt loam or silty clay loam. It is slightly acid to moderately alkaline. The C horizon has hue of 10YR or 7.5YR, value of 6 to 8 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Wakeen series

The Wakeen series consists of moderately deep, well drained, moderately permeable soils formed in material weathered from chalky shale and limestone on uplands. Slope ranges from 1 to 15 percent.

Wakeen soils are similar to Nibson and Uly soils and are commonly adjacent to those soils and to Harney soils. Harney soils are on the upper side slopes. Their subsoil is more clayey than that of the Wakeen soils. Uly soils do not have bedrock within a depth of 40 inches. They are on the middle side slopes above the Wakeen soils. Nibson soils have bedrock at a depth of 10 to 20 inches. They are steeper than the Wakeen soils and are on the lower side slopes.

Typical pedon of Wakeen silt loam, 3 to 6 percent slopes, 2,490 feet north and 150 feet west of the southeast corner of sec. 8, T. 18 S., R. 14 W.

A1—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; strong medium granular structure; slightly hard, friable; many fine roots; less than 2 percent fine limestone fragments; strong effervescence; moderately alkaline; clear smooth boundary.

B2—12 to 24 inches; light brownish gray (10YR 6/2) silty clay loam, dark brown (10YR 4/3) moist; moderate medium granular structure; slightly hard, friable; few fine roots; less than 3 percent fine limestone fragments; many soft masses of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

B3—24 to 36 inches; very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) moist; weak fine prismatic structure parting to weak fine granular; slightly hard, friable; few fine roots; less than 5 percent fine limestone fragments; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—36 inches; soft chalky limestone and shale.

The thickness of the solum, or the depth to chalky limestone and shale, ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. Lime and soft chalk fragments are throughout the solum but make up less than 5 percent of the volume. Reaction is mildly alkaline to strongly alkaline.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. It is silt loam or silty clay loam.

Waldeck series

The Waldeck series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in loamy alluvium over sandy alluvium. Slope is 0 to 1 percent.

Waldeck soils are commonly adjacent to Kaski, Platte, and Zenda soils. The well drained Kaski soils are on terraces. Their subsoil is more clayey than that of the Waldeck soils. Platte soils are on flood plains near the Arkansas River. Their subsoil is more sandy than that of the Waldeck soils. Zenda soils are on flood plains along the Arkansas River. Their subsoil is more clayey than that of the Waldeck soils.

Typical pedon of Waldeck fine sandy loam, 1,420 feet south and 250 feet west of the northeast corner of sec. 22, T. 20 S., R. 14 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—7 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

AC—11 to 21 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; few fine faint yellowish brown (10YR 5/4) and light gray (10YR 7/2) mottles; weak medium granular structure; slightly hard, very friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—21 to 30 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; few fine faint yellowish brown (10YR 5/4) and common medium distinct light gray (10YR 7/2) mottles; massive; hard, very friable; few fine roots; strong effervescence; moderately alkaline; diffuse wavy boundary.

C2—30 to 60 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few thin strata of coarse sand and fine gravel; mildly alkaline.

The thickness of the solum ranges from 18 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to lime ranges from 0 to 12 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam and sandy

loam. The AC horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is fine sandy loam or sandy loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is fine sandy loam or sandy loam in the upper part and fine sand or sand in the lower part.

Zenda series

The Zenda series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains along the Arkansas River. These soils formed in loamy alluvial sediments. Slope is 0 to 1 percent.

Zenda soils are commonly adjacent to Hord, Kaski, and Waldeck soils. Hord and Kaski soils are on terraces. They are dark to a depth of 20 to 40 inches. Also, Hord soils have a subsoil that is more silty than that of the Zenda soils. Waldeck soils are at about the same level on the landscape as the Zenda soils. Their subsoil is more sandy than that of the Zenda soils.

Typical pedon of Zenda loam, 2,475 feet west and 2,475 feet south of the northeast corner of sec. 4, T. 20 S., R. 13 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

A12—6 to 18 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

AC—18 to 26 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; hard, friable; few fine roots; strong effervescence; moderately alkaline; diffuse smooth boundary.

C1—26 to 38 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common fine distinct reddish yellow (7.5YR 6/6) mottles; weak fine subangular blocky structure; hard, firm; few fine roots; many fine soft masses of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—38 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common medium distinct reddish yellow (7.5YR 6/6) and light gray (N 6/0) mottles; weak fine subangular blocky structure; hard, firm; many fine and medium soft masses of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 35 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to lime ranges from 8 to 20 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. It is neutral to moderately alkaline. It is dominantly loam, but the range includes clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly clay loam or loam. In some pedons, however, it is sandy loam or loamy sand below a depth of 40 inches. It is mildly alkaline or moderately alkaline.

factors of soil formation

The characteristics of a soil are determined by the interaction among five factors of soil formation—climate, plants and other living organisms, parent material, relief, and time. Each of these factors affects the formation of every soil, and each modifies the effects of the other four. The effects of the individual factors vary from place to place.

Climate and vegetation act on the parent material and gradually change it to a natural body of soil. Relief modifies the effects of climate and vegetation, mainly through its effect on runoff and temperature. The nature of the parent material also affects the kind of soil that forms. Time is needed for changing the parent material into a soil. Generally, a long period is needed for the formation of distinct horizons.

parent material

Parent material is the weathered rock or partly weathered material in which soils form. It affects texture, structure, color, natural fertility, and many other soil properties. The soils in Barton County formed in alluvium, eolian sand, loess, and residuum of chalky limestone and shale or sandstone.

Alluvium is sediment deposited by floodwater in stream valleys. The geologic material carried from the Rocky Mountains by the Arkansas River is known as the Meade Formation. This old alluvium is the parent material of Carwile and Farnum soils. It is loamy or clayey and is interbedded with coarse sand, fine sand, and gravel in some areas. Canadian, Kaski, Platte, Waldeck, and Zenda soils formed in the recent alluvium on the flood plains along the Arkansas River. The sediments along the smaller drainageways are of local origin. Bridgeport, Hord, and Roxbury soils formed in these sediments.

Eolian sand is sandy material transported by wind. The source of the eolian sand in Barton County is the alluvial sediments deposited by the Arkansas River. The wind transported the sandy material as much as 40 miles from the original alluvial source (*4*). Pratt and Tivoli soils formed in this sandy material.

Loess is silty material that was transported by the wind as much as hundreds of miles from its source. Peorian Loess of the Wisconsin Stage, which covers many of the uplands in the northern part of the county, was deposited during the Pleistocene Epoch. In most areas it is brown or light gray, calcareous, and friable. Crete, Harney, and Uly soils formed in this material. Loveland Loess is light reddish brown material that was deposited during Illinoian time. Geary soils formed in this material.

The parent material in much of the northern part of the county weathered from chalky limestone and shale or sandstone. The chalky limestone and shale are of the Upper Cretaceous System. The calcareous Nibson and Wakeen soils formed in residuum of these chalky rocks. Hedville and Lancaster soils formed in material weathered from sandstone of the Dakota Formation, which is in the Lower Cretaceous System.

Tabler and Drummond soils formed on the floor of an elliptical basin called the Cheyenne Bottoms. Stream erosion during the Pleistocene period and salt solution and subsidence played an important part in the origin and configuration of these bottoms (*3*). Cretaceous rocks form the north, west, and south sides of the basin, and eolian sands are on the east side. Blood and Deception Creeks are the only streams flowing into the Cheyenne Bottoms.

climate

Climate is an active factor of soil formation. It directly affects soil formation by weathering the parent material. It indirectly affects soil formation through its effect on the plants and animals in or on the soil.

The continental climate of Barton County is characterized by intermittent dry and moist periods. These periods can last for less than a year or for several years. The soil dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become so saturated that excess moisture penetrates the substratum. The accumulation of soft lime in the substratum of Harney soils is evidence of this excess moisture. As a result of this wetting and drying, some of the basic nutrients, and even clay particles, have been leached from the upper horizons of some soils.

plant and animal life

Plants generally affect the content of nutrients and of organic matter in the soil and the color of the surface layer. Earthworms, cicadas, burrowing animals, and other animals help to keep the soil open and porous. Earthworms have left many wormcasts in Bridgeport soils. Bacteria and fungi help to decompose the plants, thus releasing plant nutrients.

The mid and tall prairie grasses have affected soil formation in Barton County more significantly than other forms of plant and animal life. As a result of the grasses, the upper part of a typical soil in the county is dark and is high in content of organic matter. The next part in many areas is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color and high in content of carbonates.

relief

Relief affects soil formation through its effect on drainage, runoff, plant cover, and soil temperature. The soil temperature, for example, is slightly lower on the east- and north-facing slopes than on west- and south-facing slopes. Most important is the effect of relief on the movement of water on the surface and into the soil.

The runoff rate is higher on the steeper soils in the uplands than on the less steep soils. As a result, erosion is more extensive. Relief has retarded the formation of Hedville soils, which formed in the oldest parent material in the county. Runoff is medium on these moderately sloping and strongly sloping soils, and much of the soil material is removed as soon as the soil forms.

Soils having distinct horizons generally formed in the less sloping areas, where runoff is slow. The nearly level Roxbury soils on flood plains, for example, formed in the younger parent material in the county but have distinct horizons. Most of the precipitation received by these soils penetrates the surface.

time

Differences in the length of time that the parent materials have been in place commonly are reflected in the degree of profile development. Some soils form rapidly; others form slowly. The soils in Barton County range from immature to mature. Those on flood plains, such as Roxbury soils, are subject to stream overflow. They receive new sediment with each flood. They have a thick, dark surface layer, but the soil structure is weak. As a result, they are immature. Harney soils are considered mature because they have distinct horizons.

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glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or

browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with

rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature*					Precipitation**				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	^{o}F	^{o}F	^{o}F	^{o}F	^{o}F	In	In	In		In
January----	42.0	18.9	30.5	70	-7	0.56	0.13	1.11	2	3.7
February---	48.2	24.0	36.1	80	-4	.93	.22	1.73	2	4.9
March------	55.7	30.8	43.3	87	4	1.71	.18	2.64	3	4.8
April------	68.6	42.8	55.7	92	22	2.12	1.06	3.24	4	0.9
May--------	78.3	53.4	65.9	98	31	3.30	2.05	4.68	6	0.0
June-------	88.4	63.1	75.8	105	46	4.10	2.06	6.54	7	0.0
July-------	93.4	68.2	80.8	106	53	3.61	1.82	5.67	6	0.0
August-----	92.3	66.5	79.4	107	52	2.80	1.22	4.12	4	0.0
September--	82.5	57.0	69.8	102	38	2.69	.95	4.10	4	0.0
October----	72.3	46.0	59.2	95	25	1.89	.33	3.08	3	0.3
November---	55.3	32.1	43.7	78	4	1.08	.08	2.15	2	2.3
December---	45.0	23.0	34.0	70	-1	.80	.13	1.31	2	4.8
Year-----	68.5	43.8	56.2	109	-7	25.59	19.87	30.72	45	21.7

* Data were recorded in the period 1951-76 at Great Bend, Kansas.

** Most data were recorded in the period 1951-76 at Great Bend, Kansas. Average snowfall data were recorded in the period 1951-73 at Larned, Kansas.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 14	April 27	May 8
2 years in 10 later than--	April 9	April 22	May 3
5 years in 10 later than--	March 31	April 12	April 23
First freezing temperature in fall:			
1 year in 10 earlier than--	October 22	October 16	October 6
2 years in 10 earlier than--	October 26	October 21	October 10
5 years in 10 earlier than--	November 5	October 30	October 20

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	201	184	161
8 years in 10	207	190	168
5 years in 10	219	201	180
2 years in 10	231	212	192
1 year in 10	238	218	198

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Aa	Attica loamy fine sand, 1 to 4 percent slopes	2,380	0.4
Ba	Bridgeport silt loam	7,500	1.3
Ca	Canadian fine sandy loam	2,670	0.5
Cb	Carwile fine sandy loam	4,300	0.7
Cr	Crete silt loam	73,700	12.8
Dt	Dillwyn-Tivoli complex, 0 to 15 percent slopes	3,200	0.6
Dw	Drummond silt loam	23,500	4.1
Fa	Farnum fine sandy loam	5,400	0.9
Fb	Farnum loam	4,200	0.7
Gb	Geary silt loam, 1 to 3 percent slopes	5,700	1.0
Gc	Geary silt loam, 3 to 7 percent slopes	13,400	2.3
Hb	Harney silt loam, 1 to 4 percent slopes	185,300	32.4
Ho	Holdrege silt loam, 1 to 3 percent slopes	4,570	0.8
Hr	Hord silt loam	30,100	5.2
Ka	Kaski loam	5,700	1.0
La	Lancaster-Hedville complex, 3 to 15 percent slopes	1,800	0.3
Na	Naron fine sandy loam, 0 to 3 percent slopes	19,600	3.4
Nb	Ness silty clay	870	0.2
Nc	New Cambria silty clay loam	19,400	3.4
Nw	Nibson-Wakeen silt loams, 3 to 15 percent slopes	22,500	3.9
Pa	Platte fine sandy loam	9,260	1.6
Pd	Pratt loamy fine sand, undulating	19,200	3.3
Pr	Pratt loamy fine sand, rolling	5,870	1.0
Ps	Pratt-Carwile loamy fine sands, 0 to 5 percent slopes	6,000	1.0
Pt	Pratt-Tivoli loamy fine sands, rolling	5,400	0.9
Ra	Roxbury silt loam, flooded	15,500	2.7
Ta	Tabler silt loam	12,900	2.2
Tb	Tabler-Drummond silt loams	8,000	1.4
Tv	Tivoli fine sand, hilly	790	0.1
Ub	Uly silt loam, 3 to 6 percent slopes	12,500	2.2
Wa	Wakeen silt loam, 1 to 3 percent slopes	5,800	1.0
Wb	Wakeen silt loam, 3 to 6 percent slopes	12,000	2.1
Wc	Waldeck fine sandy loam	8,900	1.5
Za	Zenda loam	5,650	1.0
	Water	11,800	2.1
	Total	575,360	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Winter wheat		Grain sorghum		Alfalfa hay		Corn		Smooth bromegrass	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Ton	Ton	Bu	Bu	AUM*	AUM*
Aa----- Attica	30	45	46	105	3.0	6.5	---	130	5.5	11.0
Ba----- Bridgeport	34	55	52	115	3.5	6.5	---	140	4.5	11.0
Ca----- Canadian	36	50	58	---	3.5	6.5	---	130	5.0	10.0
Cb----- Carwile	28	40	40	---	3.5	6.5	---	130	5.0	10.0
Cr----- Crete	34	55	48	110	2.5	5.5	---	125	4.5	9.0
Dt----- Dillwyn-Tivoli	---	---	---	---	---	---	---	---	---	---
Dw----- Drummond	---	---	---	---	---	---	---	---	---	---
Fa----- Farnum	37	50	54	110	2.5	6.5	---	135	4.5	10.0
Fb----- Farnum	38	55	56	120	3.0	7.0	---	135	5.0	10.0
Gb----- Geary	34	50	52	115	3.0	7.0	---	115	6.0	11.0
Gc----- Geary	31	---	48	105	2.5	6.0	---	110	4.5	8.0
Hb----- Harney	34	45	48	115	2.5	5.5	---	115	3.5	8.0
Ho----- Holdrege	36	50	50	120	3.0	6.5	---	140	4.0	8.5
Hr----- Hord	38	55	56	125	3.5	7.0	---	140	5.0	11.0
Ka----- Kaski	38	50	56	120	3.0	7.0	---	140	6.5	11.0
La----- Lancaster-Hedville	---	---	---	---	---	---	---	---	---	---
Na----- Naron	35	45	54	120	3.0	7.0	---	135	5.5	10.0
Nb----- Ness	---	---	---	---	---	---	---	---	---	---
Nc----- New Cambria	35	45	52	110	3.0	6.0	---	---	3.5	10.5
Nw----- Nibson-Wakeen	---	---	---	---	---	---	---	---	---	---
Pa----- Platte	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat		Grain sorghum		Alfalfa hay		Corn		Smooth bromegrass	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Ton	Ton	Bu	Bu	AUM*	AUM*
Pd------------------------ Pratt	29	35	48	90	---	5.5	---	115	2.5	8.0
Pr------------------------ Pratt	26	30	44	85	---	5.5	---	110	2.0	8.0
Ps------------------------ Pratt-Carwile	30	35	42	---	---	4.5	---	105	3.0	8.0
Pt------------------------ Pratt-Tivoli	---	---	---	---	---	---	---	---	---	---
Ra------------------------ Roxbury	32	55	48	---	3.0	6.5	---	135	5.0	11.0
Ta------------------------ Tabler	32	35	46	---	2.5	5.5	---	100	3.5	9.0
Tb------------------------ Tabler-Drummond	26	---	34	---	---	---	---	---	---	---
Tv------------------------ Tivoli	---	---	---	---	---	---	---	---	---	---
Ub------------------------ Uly	29	---	44	90	2.0	4.5	---	105	3.5	11.0
Wa------------------------ Wakeen	28	---	40	---	---	---	---	---	3.0	---
Wb------------------------ Wakeen	25	---	36	---	---	---	---	---	2.0	---
Wc------------------------ Waldeck	31	45	48	100	3.5	5.5	---	120	7.0	11.0
Za------------------------ Zenda	33	50	50	85	4.0	5.5	---	100	7.0	11.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Aa: Attica	Sandy	Favorable	4,500	Sand bluestem	20
		Normal	3,000	Little bluestem	20
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Big bluestem	10
				Sand lovegrass	5
				Sand dropseed	5
				Blue grama	5
Ba: Bridgeport	Loamy Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Western wheatgrass	15
		Unfavorable	3,000	Switchgrass	10
				Little bluestem	10
				Sideoats grama	10
				Indiangrass	5
				Maximilian sunflower	5
Ca: Canadian	Sandy Terrace	Favorable	7,000	Big bluestem	25
		Normal	5,000	Indiangrass	15
		Unfavorable	4,000	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Compassplant	5
				Sedge	5
Cb: Carwile	Sandy	Favorable	5,000	Switchgrass	25
		Normal	3,800	Little bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Sand bluestem	5
				Scribner panicum	5
				Canada wildrye	5
				Sideoats grama	5
Cr: Crete	Clay Upland	Favorable	4,000	Big bluestem	25
		Normal	2,800	Little bluestem	15
		Unfavorable	2,000	Switchgrass	10
				Sideoats grama	10
				Indiangrass	5
				Western wheatgrass	5
				Tall dropseed	5
				Buffalograss	5
				Blue grama	5
Dt*:					
Dillwyn	Subirrigated	Favorable	9,000	Indiangrass	15
		Normal	8,000	Big bluestem	15
		Unfavorable	7,000	Eastern gamagrass	15
				Switchgrass	10
				Prairie cordgrass	10
				Little bluestem	5
				Sedge	5
				Meadow dropseed	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Dt*:					
Tivoli	Sands	Favorable	4,000	Sand bluestem	30
		Normal	3,000	Little bluestem	20
		Unfavorable	2,000	Texas bluestem	5
				Sand lovegrass	5
				Indiangrass	5
				Sand dropseed	5
				Switchgrass	5
Dw: Drummond	Saline Lowland	Favorable	7,000	Prairie cordgrass	30
		Normal	5,800	Switchgrass	10
		Unfavorable	5,000	Indiangrass	10
				Inland saltgrass	10
				Little bluestem	5
				Western wheatgrass	5
				Alkali sacaton	5
				Sunflower	5
				Sedge	5
Fa: Farnum	Sandy	Favorable	5,000	Sand bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,500	Big bluestem	10
				Indiangrass	10
				Switchgrass	10
				Sand lovegrass	5
Fb: Farnum	Loamy Upland	Favorable	5,500	Little bluestem	25
		Normal	4,000	Big bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Sand bluestem	10
				Sideoats grama	5
Gb, Gc: Geary	Loamy Upland	Favorable	5,000	Big bluestem	35
		Normal	3,500	Little bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Tall dropseed	5
				Sideoats grama	5
Hb: Harney	Loamy Upland	Favorable	4,500	Big bluestem	30
		Normal	3,500	Little bluestem	15
		Unfavorable	2,000	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
				Western ragweed	5
Ho: Holdrege	Loamy Upland	Favorable	4,500	Big bluestem	30
		Normal	3,500	Little bluestem	20
		Unfavorable	2,000	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Indiangrass	5
				Buffalograss	5
Hr: Hord	Loamy Terrace	Favorable	5,500	Big bluestem	30
		Normal	4,000	Little bluestem	10
		Unfavorable	3,000	Switchgrass	10
				Indiangrass	5
				Sideoats grama	5
				Blue grama	5
				Tall dropseed	5
				Western wheatgrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ka-- Kaski	Loamy Terrace	Favorable	6,500	Big bluestem	30
		Normal	5,000	Western wheatgrass	15
		Unfavorable	3,500	Switchgrass	10
				Little bluestem	10
				Sideoats grama	10
				Indiangrass	5
La*:					
Lancaster	Loamy Upland	Favorable	5,000	Big bluestem	30
		Normal	3,500	Little bluestem	25
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
Hedville	Shallow Sandstone	Favorable	4,000	Little bluestem	35
		Normal	3,000	Big bluestem	30
		Unfavorable	2,000	Switchgrass	5
				Indiangrass	5
				Sideoats grama	5
Na-- Naron	Sandy	Favorable	4,500	Sand bluestem	25
		Normal	3,000	Little bluestem	20
		Unfavorable	2,000	Big bluestem	10
				Indiangrass	10
				Switchgrass	10
				Sand lovegrass	5
Nc-- New Cambria	Clay Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Little bluestem	15
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Western wheatgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Blue grama	5
Nw*:					
Nibson	Limy Upland	Favorable	4,000	Big bluestem	30
		Normal	2,500	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	20
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5
Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Pa-- Platte	Subirrigated	Favorable	7,000	Big bluestem	30
		Normal	6,000	Switchgrass	15
		Unfavorable	5,000	Indiangrass	10
				Prairie cordgrass	10
				Little bluestem	5
				Eastern gamagrass	5
Pd, Pr-- Pratt	Sands	Favorable	4,500	Sand bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Sand lovegrass	10
				Switchgrass	5
				Blue grama	5
				Sand dropseed	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ps*:					
Pratt	Sands	Favorable	4,500	Sand bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Sand lovegrass	10
				Switchgrass	5
				Blue grama	5
				Sand dropseed	5
Carwile	Sandy	Favorable	4,000	Little bluestem	30
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Indiangrass	10
				Sand lovegrass	10
				Switchgrass	5
				Sideoats grama	5
Pt*:					
Pratt	Sands	Favorable	4,500	Sand bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,500	Indiangrass	10
				Sand lovegrass	10
				Switchgrass	5
				Blue grama	5
				Sand dropseed	5
Tivoli	Choppy Sands	Favorable	4,000	Little bluestem	25
		Normal	3,000	Sand bluestem	20
		Unfavorable	2,000	Big sandreed	10
				Texas bluegrass	10
				Sand lovegrass	5
				Scribner panicum	5
				Sand dropseed	5
Ra Roxbury	Loamy Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Western wheatgrass	15
		Unfavorable	3,000	Switchgrass	10
				Little bluestem	10
				Sideoats grama	10
				Indiangrass	5
				Maximilian sunflower	5
Ta Tabler	Clay Upland	Favorable	3,800	Little bluestem	25
		Normal	2,600	Big bluestem	20
		Unfavorable	1,800	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Buffalograss	5
Tabler	Clay Upland	Favorable	3,800	Little bluestem	25
		Normal	2,600	Big bluestem	20
		Unfavorable	1,800	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Buffalograss	5
Drummond	Saline Lowland	Favorable	7,000	Prairie cordgrass	30
		Normal	5,800	Switchgrass	10
		Unfavorable	5,000	Indiangrass	10
				Inland saltgrass	10
				Little bluestem	5
				Western wheatgrass	5
				Alkali sacaton	5
				Sunflower	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Tv: Tivoli	Choppy Sands	Favorable	3,000	Little bluestem	25
		Normal	2,000	Sand bluestem	20
		Unfavorable	1,000	Big sandreed	10
				Texas bluegrass	10
				Sand lovegrass	5
				Scribner panicum	5
				Sand dropseed	5
Ub: Uly	Loamy Upland	Favorable	4,500	Big bluestem	30
		Normal	3,500	Little bluestem	20
		Unfavorable	2,000	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5
Wa, Wb: Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Wc: Waldeck	Subirrigated	Favorable	9,000	Big bluestem	25
		Normal	8,000	Indiangrass	15
		Unfavorable	7,000	Switchgrass	10
				Eastern gamagrass	10
				Prairie cordgrass	10
				Little bluestem	5
				Sedge	5
Za: Zenda	Subirrigated	Favorable	9,000	Big bluestem	25
		Normal	8,000	Indiangrass	15
		Unfavorable	7,000	Switchgrass	10
				Eastern gamagrass	10
				Prairie cordgrass	10
				Little bluestem	5
				Sedge	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Aa-----------------Attica	Lilac, American plum.	Common chokecherry	Eastern redcedar, Russian mulberry, ponderosa pine, Scotch pine, honeylocust, Austrian pine, green ash, common hackberry.	Siberian elm------	---
Ba-----------------Bridgeport	American plum-----	Amur maple, lilac	Eastern redcedar, Russian-olive, Austrian pine, green ash, ponderosa pine, Russian mulberry.	Common hackberry, honeylocust.	Siberian elm.
Ca-----------------Canadian	American plum-----	Lilac, Amur honeysuckle.	Northern catalpa, osageorange, eastern redcedar, green ash.	Scotch pine, Austrian pine, honeylocust.	American sycamore, eastern cottonwood.
Cb-----------------Carwile	American plum-----	Amur honeysuckle, lilac.	Osageorange, eastern redcedar, ponderosa pine, Austrian pine, green ash, Russian-olive.	Honeylocust, common hackberry.	Eastern cottonwood.
Cr-----------------Crete	Amur honeysuckle, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, common hackberry.	Austrian pine, honeylocust, green ash, Russian-olive, Russian mulberry.	Siberian elm------	---
Dt*:					
Dillwyn-----------	American plum, redosier dogwood.	Amur honeysuckle, lilac, common chokecherry.	Russian-olive, eastern redcedar, Austrian pine, ponderosa pine, Russian mulberry.	Honeylocust-------	Eastern cottonwood.
Tivoli------------	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine.	---	---
Dw-----------------Drummond	Siberian peashrub, lilac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Golden willow, Siberian elm, green ash.	---	Eastern cottonwood.
Fa, Fb-------------Farnum	Peking cotoneaster, fragrant sumac.	Russian mulberry, common chokecherry.	Eastern redcedar, Austrian pine, common hackberry, honeylocust, bur oak, green ash, Russian-olive.	---	Siberian elm.
Gb, Gc-------------Geary	Lilac, fragrant sumac, Amur honeysuckle.	Russian mulberry	Eastern redcedar, common hackberry, bur oak, green ash, Russian-olive, Austrian pine, honeylocust.	Siberian elm------	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Hb-----------------Harney	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, bur oak, honeylocust, Russian-olive, Austrian pine, green ash, common hackberry.	Siberian elm------	---
Ho-----------------Holdrege	Lilac, Amur honeysuckle, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, common hackberry, bur oak, Russian-olive.	Siberian elm------	---
Hr-----------------Hord	American plum-----	Lilac, Tatarian honeysuckle.	Eastern redcedar, ponderosa pine, Austrian pine, green ash, Russian mulberry, Russian-olive.	Honeylocust, common hackberry.	Eastern cottonwood.
Ka-----------------Kaski	American plum-----	Lilac, Amur honeysuckle.	Eastern redcedar, Austrian pine, green ash, Russian mulberry, ponderosa pine, Russian-olive.	Common hackberry, honeylocust.	Eastern cottonwood.
La*: Lancaster----------	Fragrant sumac, lilac, Siberian peashrub.	Rocky Mountain juniper, Russian mulberry, Russian-olive.	Eastern redcedar, green ash, Austrian pine, bur oak, honeylocust.	Siberian elm------	---
Hedville.					
Na-----------------Naron	Lilac, American plum.	Common chokecherry	Eastern redcedar, ponderosa pine, common hackberry, Russian mulberry, green ash, honeylocust, Austrian pine, Scotch pine.	Siberian elm------	---
Nb. Ness					
Nc-----------------New Cambria	---	Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Russian-olive, ponderosa pine, green ash, Russian mulberry, eastern redcedar.	Siberian elm, common hackberry, honeylocust.	Eastern cottonwood.
Nw*: Nibson.					
Wakeen------------	Siberian peashrub, fragrant sumac, silver buffaloberry.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---
Pa-----------------Platte	Redosier dogwood, American plum.	Common chokecherry	Common hackberry, green ash, Austrian pine, Russian-olive, eastern redcedar.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Pd, Pr: Pratt	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
Ps*:					
Pratt	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
Carwile	American plum	Amur honeysuckle, lilac.	Osageorange, Russian-olive, eastern redcedar, ponderosa pine, Austrian pine, green ash.	Honeylocust, common hackberry.	Eastern cottonwood.
Pt*:					
Pratt	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
Tivoli	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
Ra: Roxbury	---	Tatarian honeysuckle, Siberian peashrub, silver buffaloberry.	Eastern redcedar, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Siberian elm, common hackberry, honeylocust.	Eastern cottonwood.
Ta: Tabler	Amur honeysuckle, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, common hackberry, green ash, Russian-olive.	Honeylocust, osageorange, Austrian pine.	Siberian elm	---
Tb*:					
Tabler	Amur honeysuckle, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain, juniper, common hackberry, green ash, Russian-olive.	Honeylocust, osageorange, Austrian pine.	Siberian elm	---
Drummond	Silver buffaloberry, Tatarian honeysuckle, lilac, Siberian peashrub.	Eastern redcedar, Russian-olive, Rocky Mountain juniper.	Golden willow, green ash, Siberian elm.	---	Eastern cottonwood.
Tv: Tivoli	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
Ub: Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, common hackberry, bur oak.	Siberian elm	---
Wa, Wb: Wakeen	Siberian peashrub, fragrant sumac, silver buffaloberry.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Wc----------------- Waldeck	---	Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Russian mulberry, ponderosa pine, green ash, Russian-olive.	Common hackberry Siberian elm, honeylocust.	Eastern cottonwood.
Za----------------- Zenda	---	Silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, green ash, ponderosa pine, Russian-olive, Russian mulberry.	Common hackberry, Siberian elm, honeylocust.	Eastern cottonwood.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aa: Attica	Slight	Slight	Moderate: slope.	Slight.
Ba: Bridgeport	Severe: flooding.	Slight	Slight	Slight.
Ca: Canadian	Severe: flooding.	Slight	Slight	Slight.
Cb: Carwile	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Cr: Crete	Slight	Slight	Slight	Severe: erodes easily.
Dt*:				
Dillwyn	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Tivoli	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Dw: Drummond	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.
Fa, Fb: Farnum	Slight	Slight	Slight	Slight.
Gb, Gc: Geary	Slight	Slight	Moderate: slope.	Slight.
Hb: Harney	Slight	Slight	Moderate: slope.	Slight.
Ho: Holdrege	Slight	Slight	Moderate: slope.	Slight.
Hr: Hord	Severe: flooding.	Slight	Slight	Slight.
Ka: Kaski	Severe: flooding.	Slight	Slight	Slight.
La*:				
Lancaster	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Hedville	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones.	Slight.
Na: Naron	Slight	Slight	Slight	Slight.
Nb: Ness	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
Nc: New Cambria	Severe: flooding.	Slight	Slight	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Nw*:				
Nibson	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Wakeen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Pa Platte	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Pd Pratt	Slight	Slight	Moderate: slope.	Slight.
Pr Pratt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ps*:				
Pratt	Slight	Slight	Moderate: slope.	Slight,
Carwile	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pt*:				
Pratt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Tivoli	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ra Roxbury	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Ta Tabler	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.
Tb*:				
Tabler	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.
Drummond	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.
Tv Tivoli	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Ub Uly	Slight	Slight	Moderate: slope.	Slight.
Wa, Wb Wakeen	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Wc Waldeck	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight.
Za Zenda	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Aa------------------ Attica	Fair	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Ba------------------ Bridgeport	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Fair.
Ca------------------ Canadian	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor	Good.
Cb------------------ Carwile	Fair	Good	Good	Good	Good	Fair	Good	Fair	Good.
Cr------------------ Crete	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor	Good.
Dt*:									
Dillwyn------------	Poor	Good	Good	Good	Fair	Fair	Fair	Fair	Good.
Tivoli-------------	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Dw------------------ Drummond	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Fa, Fb-------------- Farnum	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Gb------------------ Geary	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Good.
Gc------------------ Geary	Fair	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor	Good.
Hb------------------ Harney	Good	Good	Fair	Fair	Poor	Fair	Fair	Poor	Good.
Ho------------------ Holdrege	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Very poor	Fair.
Hr------------------ Hord	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
Ka------------------ Kaski	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor	Good.
La*:									
Lancaster----------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Hedville-----------	Very poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Na------------------ Naron	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Nb------------------ Ness	Poor	Poor	Poor	Poor	Fair	Good	Poor	Good	Poor.
Nc------------------ New Cambria	Good	Good	Fair	Good	Fair	Poor	Fair	Fair	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Nw*:									
Nibson	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Wakeen	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Fair.
Pa: Platte	Fair	Good	Fair	Good	Fair	Good	Fair	Good	Fair.
Pd, Pr: Pratt	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Ps*:									
Pratt	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Carwile	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good.
Pt*:									
Pratt	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Tivoli	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Ra: Roxbury	Good	Good	Good	Fair	Poor	Fair	Good	Poor	Fair.
Ta: Tabler	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Good.
Tb*:									
Tabler	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Good.
Drummond	Poor	Fair	Fair	Poor	Fair	Fair	Fair	Fair	Poor.
Tv: Tivoli	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Ub: Uly	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Very poor	Good.
Wa, Wb: Wakeen	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Fair.
Wc: Waldeck	Fair	Good	Good	Good	Fair	Fair	Good	Fair	Good.
Za: Zenda	Fair	Good	Good	Good	Fair	Fair	Good	Fair	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aa: Attica	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Ba: Bridgeport	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Ca: Canadian	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Cb: Carwile	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, shrink-swell, ponding.
Cr: Crete	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Dt*:					
Dillwyn	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.
Tivoli	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Dw: Drummond	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Fa, Fb: Farnum	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Gb: Geary	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Gc: Geary	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Hb: Harney	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ho: Holdrege	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Hr: Hord	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Ka: Kaski	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
La*:					
Lancaster	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.
Hedville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Na: Naron	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Nb: Ness	Severe: cutbanks cave, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.
Nc: New Cambria	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Nw*:					
Nibson	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.
Wakeen	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
Pa: Platte	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.
Pd: Pratt	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Pr: Pratt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Ps*:					
Pratt	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Carwile	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, shrink-swell, ponding.
Pt*:					
Pratt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Tivoli	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Ra: Roxbury	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Ta: Tabler	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Tb*:					
Tabler	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Drummond	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Tv---------------- Tivoli	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ub---------------- Uly	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Severe: low strength.
Wa---------------- Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wb---------------- Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Wc---------------- Waldeck	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
Za---------------- Zenda	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aa: Attica	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Ba: Bridgeport	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Ca: Canadian	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Cb: Carwile	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Cr: Crete	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
Dt*:					
Dillwyn	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Tivoli	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Dw: Drummond	Severe: wetness, percs slowly.	Severe: flooding.	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.
Fa, Fb: Farnum	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Gb, Gc: Geary	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Hb: Harney	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Ho: Holdrege	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Hr: Hord	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Ka: Kaski	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
La*:					
Lancaster	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Hedville	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Na------------------ Naron	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: thin layer.
Nb------------------ Ness	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: hard to pack, ponding.
Nc------------------ New Cambria	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
Nw*:					
Nibson--------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Wakeen--------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Pa------------------ Platte	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Pd------------------ Pratt	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Pr------------------ Pratt	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Ps*:					
Pratt---------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Carwile-------------	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Pt*:					
Pratt---------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Tivoli--------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ra------------------ Roxbury	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Ta------------------ Tabler	Severe: wetness, percs slowly.	Slight-----------	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Tb*:					
Tabler--------------	Severe: wetness, percs slowly.	Slight-----------	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Drummond------------	Severe: wetness, percs slowly.	Severe: flooding.	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tv: Tivoli	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Ub: Uly	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Wa, Wb: Wakeen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Wc: Waldeck	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness, thin layer.
Za: Zenda	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aa: Attica	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Ba: Bridgeport	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ca: Canadian	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Cb: Carwile	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Cr: Crete	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Dt*:				
Dillwyn	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
Tivoli	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Dw: Drummond	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Fa, Fb: Farnum	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Gb, Gc: Geary	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hb: Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ho: Holdrege	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hr: Hord	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ka: Kaski	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
La*:				
Lancaster	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Hedville	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Na: Naron	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Nb: Ness	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Nc-------------------- New Cambria	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Nw*:				
Nibson---------------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Wakeen---------------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Pa-------------------- Platte	Fair: wetness.	Probable-------------	Probable-------------	Poor: area reclaim, small stones.
Pd-------------------- Pratt	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
Pr-------------------- Pratt	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy, slope.
Ps*:				
Pratt----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
Carwile--------------	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Pt*:				
Pratt----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy, slope.
Tivoli---------------	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy, slope.
Ra-------------------- Roxbury	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ta-------------------- Tabler	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Tb*:				
Tabler---------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Drummond-------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Tv-------------------- Tivoli	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
Ub-------------------- Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wa, Wb---------------- Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Wc-------------------- Waldeck	Fair: wetness.	Probable-------------	Improbable: too sandy.	Good.
Za-------------------- Zenda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Aa: Attica	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
Ba: Bridgeport	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ca: Canadian	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Cb: Carwile	Moderate: seepage.	Severe: ponding.	Percs slowly, ponding.	Ponding, erodes easily soil blowing.	Erodes easily, ponding, soil blowing.	Percs slowly, wetness, erodes easily
Cr: Crete	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily	Erodes easily	Erodes easily, percs slowly.
Dt*:						
Dillwyn	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Tivoli	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Dw: Drummond	Slight	Severe: excess sodium.	Percs slowly, excess sodium	Wetness, droughty.	Erodes easily, wetness.	Excess sodium, erodes easily droughty.
Fa: Farnum	Moderate: seepage.	Severe: thin layer.	Deep to water	Soil blowing	Soil blowing	Favorable.
Fb: Farnum	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable	Favorable	Favorable.
Gb: Geary	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
Gc: Geary	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Hb: Harney	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ho: Holdrege	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Hr: Hord	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Ka: Kaski	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
La*:						
Lancaster	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock	Slope, depth to rock
Hedville	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock	Slope, depth to rock

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Na: Naron	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Nb: Ness	Moderate: seepage.	Severe: piping, hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Nc: New Cambria	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Nw*:						
Nibson	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock	Slope, depth to rock
Wakeen	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock erodes easily	Slope, erodes easily depth to rock
Pa: Platte	Severe: seepage.	Severe: seepage, wetness, piping.	Flooding, cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Pd: Pratt	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Pr: Pratt	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Ps*:						
Pratt	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Carwile	Moderate: seepage.	Severe: ponding.	Percs slowly, ponding.	Ponding, erodes easily soil blowing.	Erodes easily, ponding, soil blowing.	Percs slowly, wetness, erodes easily
Pt*:						
Pratt	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Tivoli	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Ra: Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Ta: Tabler	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
Tb*:						
Tabler	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
Drummond	Slight	Severe: excess sodium.	Percs slowly, excess sodium	Wetness, droughty.	Erodes easily, wetness.	Excess sodium, erodes easily droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Tv----------------- Tivoli	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Ub----------------- Uly	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Wa----------------- Wakeen	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock	Depth to rock, erodes easily	Erodes easily, depth to rock
Wb----------------- Wakeen	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily	Erodes easily, depth to rock
Wc----------------- Waldeck	Severe: seepage.	Severe: piping.	Flooding-------	Wetness, soil blowing, flooding.	Wetness, soil blowing.	Favorable.
Za----------------- Zenda	Moderate: seepage.	Moderate: piping, wetness.	Flooding-------	Wetness, flooding.	Wetness--------	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Aa---------------- Attica	0-8	Loamy fine sand	SM, SP-SM	A-2	0	100	95-100	70-100	10-35	---	NP
	8-20	Fine sandy loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	95-100	75-100	30-55	<26	NP-7
	20-60	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	85-100	80-100	70-100	20-50	<26	NP-7
Ba---------------- Bridgeport	0-10	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	75-100	25-40	8-20
	10-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	95-100	85-100	25-40	8-20
Ca---------------- Canadian	0-14	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-85	<31	NP-10
	14-60	Fine sandy loam, loam, sandy loam.	SM, ML, SC, CL	A-4, A-2	0	100	98-100	90-100	15-85	<31	NP-10
Cb---------------- Carwile	0-10	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4, A-2	0	100	98-100	90-100	15-60	<26	NP-7
	10-18	Clay loam, sandy clay loam.	CL, SC	A-6, A-7	0	100	100	90-100	36-90	35-50	14-26
	18-46	Clay loam, clay, sandy clay.	CL, CH, SC	A-6, A-7	0	100	100	90-100	40-95	35-70	14-38
	46-60	Clay loam, sandy clay loam, clay.	CL, CH, SC	A-4, A-6, A-7	0	100	100	90-100	36-95	25-70	7-38
Cr---------------- Crete	0-11	Silt loam--------	CL	A-4, A-6	0	100	100	100	95-100	30-40	8-15
	11-33	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-38
	33-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	15-35
Dt*:											
Dillwyn-----------	0-8	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	95-100	70-90	5-35	---	NP
	8-60	Loamy fine sand, fine sand, fine sandy loam.	SM, SP-SM	A-2, A-3	0	100	90-100	70-90	5-35	---	NP
Tivoli------------	0-6	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-25	---	NP
	6-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-25	---	NP
Dw---------------- Drummond	0-8	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	96-100	65-97	22-39	3-15
	8-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	35-60	15-35
Fa---------------- Farnum	0-12	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	70-100	30-55	<30	NP-5
	12-22	Loam-------------	CL	A-6	0	100	100	85-100	60-80	30-40	10-15
	22-42	Clay loam, sandy clay loam.	SC, CL	A-6, A-7-6	0	100	100	70-100	45-80	35-50	15-30
	42-60	Loam, clay loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-6, A-2, A-4	0	100	95-100	65-100	30-80	20-35	5-15
Fb---------------- Farnum	0-14	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	90-100	60-85	20-35	5-15
	14-26	Loam-------------	CL	A-6	0	100	100	85-100	60-80	30-40	10-15
	26-42	Clay loam, sandy clay loam.	SC, CL	A-6, A-7-6	0	100	100	70-100	45-80	35-50	15-30
	42-60	Loam, clay loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-6, A-2, A-4	0	100	95-100	65-100	30-80	20-35	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Gb, Gc------------ Geary	0-12	Silt loam---------	ML, CL	A-4, A-6	0	100	100	96-100	80-98	25-40	2-15
	12-42	Silty clay loam, clay loam.	CL	A-7, A-6	0	100	100	96-100	85-98	35-50	15-25
	42-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	96-100	85-98	30-45	11-22
Hb---------------- Harney	0-5	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	5-39	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	39-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Ho---------------- Holdrege	0-13	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-40	2-18
	13-26	Silty clay loam	CL	A-7, A-6	0	100	100	98-100	95-100	30-50	15-35
	26-60	Silt loam---------	CL, ML	A-4, A-6	0	100	100	95-100	90-100	30-40	5-15
Hr---------------- Hord	0-12	Silt loam---------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	12-39	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	39-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
Ka---------------- Kaski	0-23	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-100	50-85	20-40	5-20
	23-34	Clay loam, loam, sandy loam.	CL, SC	A-4, A-6	0	100	95-100	85-100	45-85	25-40	7-20
	34-60	Clay loam, sandy loam, loam.	CL, ML, SM, SC	A-2, A-4, A-6	0	100	95-100	60-100	30-80	<35	NP-20
La*:											
Lancaster--------	0-8	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	85-100	50-85	20-35	5-15
	8-26	Sandy clay loam, fine sandy loam, loam.	CL, SC	A-4, A-6, A-7-6	0	100	100	80-95	40-65	25-45	8-25
	26-34	Clay loam, loam, sandy clay loam.	CL-ML, SC, SM-SC, CL	A-4, A-6	0	100	100	80-100	36-80	20-35	5-15
	34	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hedville---------	0-16	Fine sandy loam	SM, ML, SC, CL	A-4, A-6	0-15	70-100	70-100	50-85	35-70	<35	NP-13
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Na---------------- Naron	0-7	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	95-100	75-100	25-60	<26	1-7
	7-44	Fine sandy loam, sandy clay loam, loam.	SC, CL	A-4, A-6	0	100	95-100	80-100	36-60	26-40	8-18
	44-60	Fine sandy loam, loamy fine sand, fine sand.	SM, SM-SC	A-2, A-4	0	100	95-100	75-100	20-50	<26	NP-7
Nb---------------- Ness	0-60	Silty clay--------	CH	A-7	0	100	100	95-100	90-100	50-70	30-45
Nc---------------- New Cambria	0-7	Silty clay loam	CH, CL	A-7	0	100	100	95-100	90-100	41-60	28-45
	7-31	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	100	100	95-100	85-100	41-60	28-45
	31-60	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	100	100	95-100	85-100	41-60	28-45
Nw*:											
Nibson-----------	0-8	Silt loam---------	CL	A-4, A-6	0-15	85-100	80-95	65-95	60-90	25-40	8-20
	8-19	Silty clay loam, silt loam.	CL	A-6, A-7	0-15	85-95	80-95	60-90	55-90	30-45	10-25
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Nw*:											
Wakeen----------	0-12	Silt loam--------	ML, CL	A-7, A-6	0	100	100	95-100	75-95	35-50	10-25
	12-36	Silty clay loam	CL, ML	A-6, A-7-6	0	100	100	95-100	85-95	35-50	10-25
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pa--------------- Platte	0-9	Fine sandy loam	ML, SM, SC, CL	A-4, A-2, A-6	0	100	95-100	60-85	30-55	20-35	3-15
	9-60	Coarse sand, loamy fine sand, sand.	SP-SM, SM	A-1, A-2, A-3	0	70-95	50-95	25-65	5-15	<20	NP
Pd, Pr----------- Pratt	0-12	Loamy fine sand	SM	A-2	0	100	95-100	70-100	15-35	---	NP
	12-28	Loamy fine sand, loamy sand, fine sandy loam.	SM, SM-SC	A-2, A-4	0	100	95-100	90-100	15-40	<20	NP-6
	28-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-35	---	NP
Ps*:											
Pratt-----------	0-12	Loamy fine sand	SM	A-2	0	100	95-100	70-100	15-35	---	NP
	12-28	Loamy fine sand, loamy sand, fine sandy loam.	SM, SM-SC	A-2, A-4	0	100	95-100	90-100	15-40	<20	NP-6
	28-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-35	---	NP
Carwile---------	0-5	Loamy fine sand	ML, SM, CL-ML, SM-SC	A-4, A-2	0	100	98-100	90-100	15-60	<26	NP-7
	5-18	Clay loam, sandy clay loam, fine sandy loam.	CL, SC	A-6, A-7	0	100	100	90-100	36-90	35-50	14-26
	18-46	Clay loam, clay, sandy clay.	CL, CH, SC	A-6, A-7	0	100	100	90-100	40-95	35-70	14-38
	46-60	Clay loam, sandy clay loam, clay.	CL, CH, SC	A-4, A-6, A-7	0	100	100	90-100	36-95	25-70	7-38
Pt*:											
Pratt-----------	0-12	Loamy fine sand	SM	A-2	0	100	95-100	70-100	15-35	---	NP
	12-28	Loamy fine sand, loamy sand, fine sandy loam.	SM, SM-SC	A-2, A-4	0	100	95-100	90-100	15-40	<20	NP-6
	28-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-35	---	NP
Tivoli----------	0-6	Loamy fine sand	SM	A-2	0	100	95-100	90-100	15-35	---	NP
	6-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-25	---	NP
Ra--------------- Roxbury	0-20	Silt loam--------	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	20-50	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25
	50-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-50	7-25
Ta--------------- Tabler	0-10	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	96-100	65-97	22-31	2-10
	10-30	Silty clay, clay	CL, CH	A-7	0	100	100	96-100	90-99	41-65	18-35
	30-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	96-100	96-100	92-100	80-99	38-60	15-35
Tb*:											
Tabler----------	0-10	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	96-100	65-97	22-31	2-10
	10-30	Silty clay, clay	CL, CH	A-7	0	100	100	96-100	90-99	41-65	18-35
	30-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	96-100	96-100	92-100	80-99	38-60	15-35

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Tb*:											
Drummond--------	0-8	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	96-100	65-97	22-39	3-15
	8-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-98	35-60	15-35
Tv---------------	0-6	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-25	---	NP
Tivoli	6-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-25	---	NP
Ub---------------	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
Uly	6-35	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	35-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
Wa, Wb-----------	0-12	Silt loam--------	ML, CL	A-7, A-6	0	100	100	95-100	75-95	35-50	10-25
Wakeen	12-36	Silty clay loam	CL, ML	A-6, A-7-6	0	100	100	95-100	85-95	35-50	10-25
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wc---------------	0-11	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	95-100	75-100	25-55	<25	NP-5
Waldeck	11-30	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	95-100	70-100	30-50	<25	NP-5
	30-60	Fine sand, sand	SM, SP, SP-SM	A-1, A-2, A-3	0	90-100	80-100	40-60	1-35	---	NP
Za---------------	0-18	Loam-------------	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	55-80	25-40	5-20
Zenda	18-60	Loam, clay loam, sandy clay loam.	CL	A-6	0	100	95-100	85-100	55-80	25-40	10-25

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	mmhos/cm					Pct
Aa--------------- Attica	0-8	2-10	1.50-1.60	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	8-20	8-18	1.50-1.60	2.0-6.0	0.12-0.17	5.6-6.5	<2	Low--------	0.24			
	20-60	4-18	1.50-1.60	2.0-6.0	0.08-0.16	6.1-7.8	<2	Low--------	0.24			
Ba--------------- Bridgeport	0-10	18-27	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.32	5	6	1-4
	10-60	18-30	1.35-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43			
Ca--------------- Canadian	0-14	5-20	1.30-1.60	2.0-6.0	0.11-0.20	5.6-8.4	<2	Low--------	0.20	5	3	1-3
	14-60	10-27	1.40-1.70	2.0-6.0	0.07-0.20	6.1-8.4	<2	Low--------	0.20			
Cb--------------- Carwile	0-10	5-18	1.30-1.65	0.6-2.0	0.11-0.20	5.1-7.3	<2	Low--------	0.24	5	3	1-3
	10-18	25-40	1.45-1.75	0.2-2.0	0.12-0.20	5.1-7.3	<2	Moderate	0.37			
	18-46	35-60	1.35-1.75	0.06-0.2	0.12-0.20	6.1-8.4	<2	High-------	0.37			
	46-60	20-45	1.35-1.75	0.2-2.0	0.12-0.20	6.6-8.4	<2	High-------	0.32			
Cr--------------- Crete	0-11	20-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.0	<2	Moderate	0.37	4	6	2-4
	11-33	42-52	1.10-1.30	0.06-0.6	0.12-0.20	6.1-7.3	<2	High-------	0.37			
	33-60	25-40	1.20-1.40	0.2-2.0	0.18-0.22	7.4-7.8	<2	High-------	0.37			
Dt*: Dillwyn----------	0-8	2-8	1.50-1.60	6.0-20	0.08-0.12	5.6-7.3	<2	Low--------	0.17	5	2	---
	8-60	2-8	1.50-1.60	6.0-20	0.06-0.10	5.6-7.8	<2	Low--------	0.17			
Tivoli----------	0-6	1-10	1.35-1.50	6.0-20.0	0.02-0.08	6.1-7.8	<2	Low--------	0.15	5	1	<1
	6-60	1-10	1.50-1.70	6.0-20.0	0.02-0.08	6.1-8.4	<2	Low--------	0.15			
Dw--------------- Drummond	0-8	20-30	1.35-1.55	0.6-2.0	0.11-0.18	6.1-8.4	<4	Low--------	0.43	3	6	.5-1
	8-60	35-60	1.40-1.65	<0.06	0.09-0.17	7.4-9.0	2-8	High-------	0.43			
Fa--------------- Farnum	0-12	8-14	1.45-1.55	2.0-6.0	0.13-0.18	5.6-7.3	<2	Low--------	0.20	5	3	1-2
	12-22	20-27	1.40-1.50	0.6-2.0	0.17-0.19	6.1-7.8	<2	Low--------	0.28			
	22-42	25-35	1.40-1.50	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.28			
	42-60	12-29	1.40-1.55	0.6-2.0	0.13-0.16	6.6-8.4	<2	Low--------	0.28			
Fb--------------- Farnum	0-14	14-29	1.35-1.45	0.6-2.0	0.19-0.22	5.6-7.3	<2	Low--------	0.28	5	6	1-3
	14-26	20-27	1.40-1.50	0.6-2.0	0.17-0.19	6.1-7.8	<2	Low--------	0.28			
	26-42	25-35	1.40-1.50	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.28			
	42-60	12-29	1.40-1.55	0.6-2.0	0.13-0.16	6.6-8.4	<2	Low--------	0.28			
Gb, Gc----------- Geary	0-12	15-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.5	<2	Low--------	0.32	5	6	1-4
	12-42	27-35	1.35-1.50	0.6-2.0	0.17-0.20	5.6-7.8	<2	Moderate	0.43			
	42-60	20-32	1.30-1.40	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.43			
Hb--------------- Harney	0-5	22-35	1.30-1.40	0.6-2.0	0.21-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	5-39	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	High-------	0.43			
	39-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.43			
Ho--------------- Holdrege	0-13	15-25	1.40-1.60	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	2-4
	13-26	28-35	1.20-1.40	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	26-60	15-20	1.40-1.60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.43			
Hr--------------- Hord	0-12	17-27	1.30-1.40	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low--------	0.32	5	6	2-4
	12-39	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low--------	0.32			
	39-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low--------	0.43			
Ka--------------- Kaski	0-23	13-35	1.35-1.45	0.6-2.0	0.18-0.22	5.6-7.3	<2	Low--------	0.28	5	6	1-3
	23-34	18-35	1.40-1.50	0.6-2.0	0.13-0.19	5.6-7.8	<2	Moderate	0.28			
	34-60	8-30	1.45-1.55	0.6-2.0	0.13-0.19	5.6-8.4	<2	Low--------	0.28			
La*: Lancaster--------	0-8	12-26	1.35-1.45	0.6-2.0	0.17-0.22	5.6-6.5	<2	Low--------	0.28	4	6	2-6
	8-26	18-35	1.35-1.50	0.6-2.0	0.15-0.19	5.6-7.3	<2	Moderate	0.28			
	26-34	12-26	1.40-1.55	0.6-2.0	0.15-0.19	6.1-7.3	<2	Low--------	0.28			
	34	---	---	---	---	---	---	-----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	mmhos/cm					Pct
La*:												
Hedville----------	0-16	8-22	1.35-1.50	0.6-2.0	0.14-0.20	5.6-7.3	<2	Low--------	0.32	2	3	1-4
	16	---	---	---	---	---	---	-----------	----			
Na---------------- Naron	0-7	8-14	1.40-1.50	0.6-6.0	0.14-0.20	5.6-7.3	<2	Low--------	0.20	5	3	1-3
	7-44	18-27	1.45-1.55	0.6-2.0	0.15-0.18	5.6-7.8	<2	Low--------	0.32			
	44-60	2-14	1.50-1.60	2.0-6.0	0.10-0.15	6.1-8.4	<2	Low--------	0.32			
Nb---------------- Ness	0-60	40-60	1.30-1.45	<0.06	0.11-0.14	6.6-8.4	<2	High-------	0.28	5	4	1-3
Nc---------------- New Cambria	0-7	35-60	1.30-1.40	0.06-0.2	0.13-0.18	6.6-8.4	<2	High-------	0.37	5	7	2-4
	7-31	38-60	1.35-1.45	0.06-0.2	0.13-0.18	7.9-8.4	<2	High-------	0.28			
	31-60	30-50	1.35-1.45	0.06-0.6	0.12-0.16	7.9-8.4	<2	High-------	0.28			
Nw*:												
Nibson-----------	0-8	15-27	1.25-1.35	0.6-2.0	0.20-0.24	7.4-9.0	<2	Low--------	0.32	2	4L	---
	8-19	18-35	1.30-1.40	0.6-2.0	0.18-0.22	7.9-9.0	<2	Moderate	0.32			
	19	---	---	---	---	---	---	-----------	----			
Wakeen-----------	0-12	18-35	1.30-1.45	0.6-2.0	0.21-0.24	7.4-8.4	<2	Moderate	0.32	4	4L	1-3
	12-36	18-35	1.35-1.50	0.6-2.0	0.18-0.32	7.4-9.0	<2	Moderate	0.43			
	36	---	---	---	---	---	---	-----------	----			
Pa---------------- Platte	0-9	5-15	1.60-1.80	2.0-6.0	0.16-0.18	6.6-8.4	<2	Low--------	0.24	2	3	1-3
	9-60	0-3	1.50-1.70	>20	0.02-0.04	6.6-8.4	<2	Low--------	0.10			
Pd, Pr------------ Pratt	0-12	2-8	1.40-1.55	6.0-20	0.10-0.13	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	12-28	4-11	1.45-1.55	6.0-20	0.09-0.12	5.6-7.3	<2	Low--------	0.17			
	28-60	1-8	1.45-1.60	6.0-20	0.08-0.12	6.1-7.3	<2	Low--------	0.17			
Ps*:												
Pratt------------	0-12	2-8	1.40-1.55	6.0-20	0.10-0.13	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	12-28	4-11	1.45-1.55	6.0-20	0.09-0.12	5.6-7.3	<2	Low--------	0.17			
	28-60	1-8	1.45-1.60	6.0-20	0.08-0.12	6.1-7.3	<2	Low--------	0.17			
Carwile----------	0-5	5-18	1.30-1.65	0.6-2.0	0.11-0.20	5.1-7.3	<2	Low--------	0.24	5	2	1-3
	5-18	25-40	1.45-1.75	0.2-2.0	0.12-0.20	5.1-7.3	<2	Moderate	0.37			
	18-46	35-60	1.35-1.75	0.06-0.2	0.12-0.20	6.1-8.4	<2	High-------	0.37			
	46-60	20-45	1.35-1.75	0.2-2.0	0.12-0.20	6.6-8.4	<2	High-------	0.32			
Pt*:												
Pratt------------	0-12	2-8	1.40-1.55	6.0-20	0.10-0.13	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	12-28	4-11	1.45-1.55	6.0-20	0.09-0.12	5.6-7.3	<2	Low--------	0.17			
	28-60	1-8	1.45-1.60	6.0-20	0.08-0.12	6.1-7.3	<2	Low--------	0.17			
Tivoli-----------	0-6	5-10	1.35-1.50	6.0-20.0	0.07-0.11	6.1-7.8	<2	Low--------	0.15	5	2	<1
	6-60	1-10	1.50-1.70	6.0-20.0	0.02-0.08	6.1-8.4	<2	Low--------	0.15			
Ra---------------- Roxbury	0-20	18-35	1.30-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low--------	0.32	5	4L	2-4
	20-50	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	50-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Ta---------------- Tabler	0-10	12-27	1.30-1.55	0.6-2.0	0.15-0.24	5.6-8.4	<2	Low--------	0.37	4	6	1-3
	10-30	40-55	1.35-1.60	<0.06	0.12-0.18	6.1-8.4	<2	High-------	0.37			
	30-60	35-55	1.35-1.65	<0.06	0.12-0.22	7.4-8.4	<2	High-------	0.37			
Tb*:												
Tabler-----------	0-10	12-27	1.30-1.55	0.6-2.0	0.15-0.24	5.6-8.4	<2	Low--------	0.37	4	6	1-3
	10-30	40-55	1.35-1.60	<0.06	0.12-0.18	6.1-8.4	<2	High-------	0.37			
	30-60	35-55	1.35-1.65	<0.06	0.12-0.22	7.4-8.4	<2	High-------	0.37			
Drummond---------	0-8	20-30	1.35-1.55	0.6-2.0	0.11-0.18	6.1-8.4	<4	Low--------	0.43	3	6	.5-1
	8-60	35-60	1.40-1.65	<0.06	0.09-0.17	7.4-9.0	2-8	High-------	0.43			
Tv---------------- Tivoli	0-6	1-10	1.35-1.50	6.0-20.0	0.02-0.08	6.1-7.8	<2	Low--------	0.15	5	1	<1
	6-60	1-10	1.50-1.70	6.0-20.0	0.02-0.08	6.1-8.4	<2	Low--------	0.15			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	mmhos/cm					Pct
Ub----------------	0-6	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
Uly	6-35	20-32	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.43			
	35-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Wa, Wb------------	0-12	18-35	1.30-1.45	0.6-2.0	0.21-0.24	7.4-8.4	<2	Moderate	0.32	4	4L	1-3
Wakeen	12-36	18-35	1.35-1.50	0.6-2.0	0.18-0.32	7.4-9.0	<2	Moderate	0.43			
	36	---	---	---	---	---	---	-----------	----			
Wc----------------	0-11	8-16	1.50-1.60	2.0-6.0	0.14-0.18	7.4-8.4	<2	Low--------	0.20	5	3	1-2
Waldeck	11-30	8-16	1.50-1.60	2.0-6.0	0.12-0.17	7.4-8.4	<2	Low--------	0.20			
	30-60	1-4	1.55-1.65	6.0-20	0.05-0.07	7.4-8.4	<2	Low--------	0.20			
Za----------------	0-18	12-32	1.45-1.55	0.6-2.0	0.17-0.22	6.6-8.4	<4	Moderate	0.28	5	6	1-3
Zenda	18-60	18-35	1.45-1.60	0.6-2.0	0.15-0.19	7.4-8.4	<4	Moderate	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
Aa----------------- Attica	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Ba----------------- Bridgeport	B	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Ca----------------- Canadian	B	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Cb----------------- Carwile	D	None---------	---	---	+1-2.0	Apparent	Oct-Apr	>60	---	High------	Moderate.
Cr----------------- Crete	D	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Dt*:											
Dillwyn-----------	A	None---------	---	---	1.0-3.0	Apparent	Jan-Dec	>60	---	Low-------	Low.
Tivoli------------	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Dw----------------- Drummond	D	Rare---------	---	---	2.0-6.0	Apparent	Nov-Apr	>60	---	High------	High.
Fa, Fb------------- Farnum	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Gb, Gc------------- Geary	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Hb----------------- Harney	C	None---------	---	---	>6.0	---	---	>60	---	High------	Low.
Ho----------------- Holdrege	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Hr----------------- Hord	B	Rare---------	---	---	>6.0	---	---	>60	---	High------	Low.
Ka----------------- Kaski	B	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
La*:											
Lancaster---------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate.
Hedville----------	D	None---------	---	---	>6.0	---	---	4-20	Hard	Low-------	Moderate.
Na----------------- Naron	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low.
Nb----------------- Ness	D	Frequent----	Long to very long.	Mar-Dec	+1-1.0	Perched	Mar-Jun	>60	---	High------	Low.
Nc----------------- New Cambria	C	Rare---------	---	---	>6.0	---	---	>60	---	High------	Low.
Nw*:											
Nibson------------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Low-------	Low.
Wakeen------------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
Pa----------------- Platte	B/D	Occasional	Brief------	Mar-Oct	1.0-2.0	Apparent	Feb-Jun	>60	---	High------	Moderate.
Pd, Pr------------- Pratt	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
Ps*:											
Pratt	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
Carwile	D	None	---	---	+1-2.0	Apparent	Oct-Apr	>60	---	High	Moderate.
Pt*:											
Pratt	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
Tivoli	A	None	---	---	>6.0	---	---	>60	---	Low	Low.
Ra Roxbury	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Low	Low.
Ta Tabler	D	None	---	---	2.5-3.5	Perched	Oct-Apr	>60	---	High	Low.
Tb*:											
Tabler	D	None	---	---	2.5-3.5	Perched	Oct-Apr	>60	---	High	Low.
Drummond	D	Rare	---	---	2.0-6.0	Apparent	Nov-Apr	>60	---	High	High.
Tv Tivoli	A	None	---	---	>6.0	---	---	>60	---	Low	Low.
Ub Uly	B	None	---	---	>6.0	---	---	>60	---	High	Low.
Wa, Wb Wakeen	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
Wc Waldeck	C	Occasional	Brief	Mar-Oct	2.0-4.0	Apparent	Oct-Apr	>60	---	Moderate	Low.
Za Zenda	C	Occasional	Very brief	Apr-Sep	2.0-4.0	Apparent	Oct-Apr	>60	---	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Attica	Coarse-loamy, mixed, thermic Udic Haplustalfs
Bridgeport	Fine-silty, mixed, mesic Fluventic Haplustolls
Canadian	Coarse-loamy, mixed, thermic Udic Haplustolls
Carwile	Fine, mixed, thermic Typic Argiaquolls
Crete	Fine, montmorillonitic, mesic Pachic Argiustolls
Dillwyn	Mixed, thermic Aquic Ustipsamments
Drummond	Fine, mixed, thermic Mollic Natrustalfs
Farnum	Fine-loamy, mixed, thermic Pachic Argiustolls
Geary	Fine-silty, mixed, mesic Udic Argiustolls
Harney	Fine, montmorillonitic, mesic Typic Argiustolls
Hedville	Loamy, mixed, mesic Lithic Haplustolls
Holdrege	Fine-silty, mixed, mesic Typic Argiustolls
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Kaski	Fine-loamy, mixed, thermic Cumulic Haplustolls
Lancaster	Fine-loamy, mixed, mesic Udic Argiustolls
Naron	Fine-loamy, mixed, thermic Udic Argiustolls
Ness	Fine, montmorillonitic, mesic Udic Pellusterts
New Cambria	Fine, montmorillonitic, mesic Cumulic Haplustolls
Nibson	Loamy, carbonatic, mesic, shallow Entic Haplustolls
*Platte	Sandy, mixed, mesic Mollic Fluvaquents
Pratt	Sandy, mixed, thermic Psammentic Haplustalfs
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
Tabler	Fine, montmorillonitic, thermic Vertic Argiustolls
Tivoli	Mixed, thermic Typic Ustipsamments
Uly	Fine-silty, mixed, mesic Typic Haplustolls
Wakeen	Fine-silty, carbonatic, mesic Entic Haplustolls
Waldeck	Coarse-loamy, mixed, thermic Fluvaquentic Haplustolls
Zenda	Fine-loamy, mixed, thermic Fluvaquentic Haplustolls

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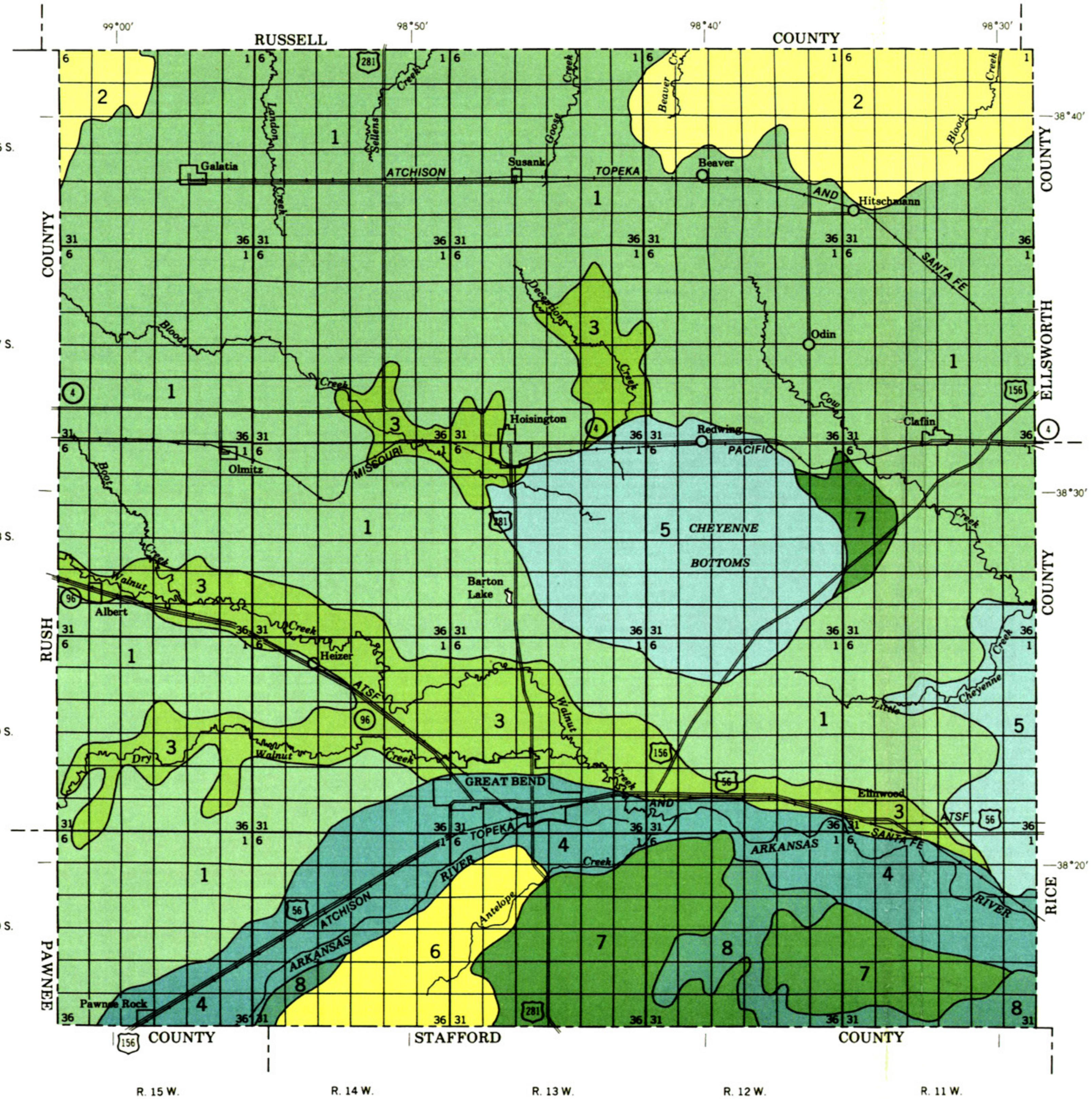


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KANSAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
BARTON COUNTY, KANSAS

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND

1	Harney-Crete association: Deep, nearly level and gently sloping, well drained and moderately well drained soils on uplands
2	Wakeen-Nibson association: Moderately deep and shallow, gently sloping to strongly sloping, well drained and somewhat excessively drained soils on uplands
3	New Cambria-Hord-Bridgeport association: Deep, nearly level, moderately well drained and well drained soils on terraces
4	Platte-Waldeck association: Deep, nearly level, somewhat poorly drained soils on flood plains
5	Drummond-Tabler association: Deep, nearly level, somewhat poorly drained and moderately well drained soils on the Cheyenne Bottoms and on old valley floors
6	Naron-Farnum association: Deep, nearly level, well drained soils on uplands
7	Pratt-Carwile association: Deep, nearly level to rolling, well drained and somewhat poorly drained soils on uplands and in upland depressions
8	Pratt-Tivoli association: Deep, undulating to hilly, well drained and excessively drained soils on uplands

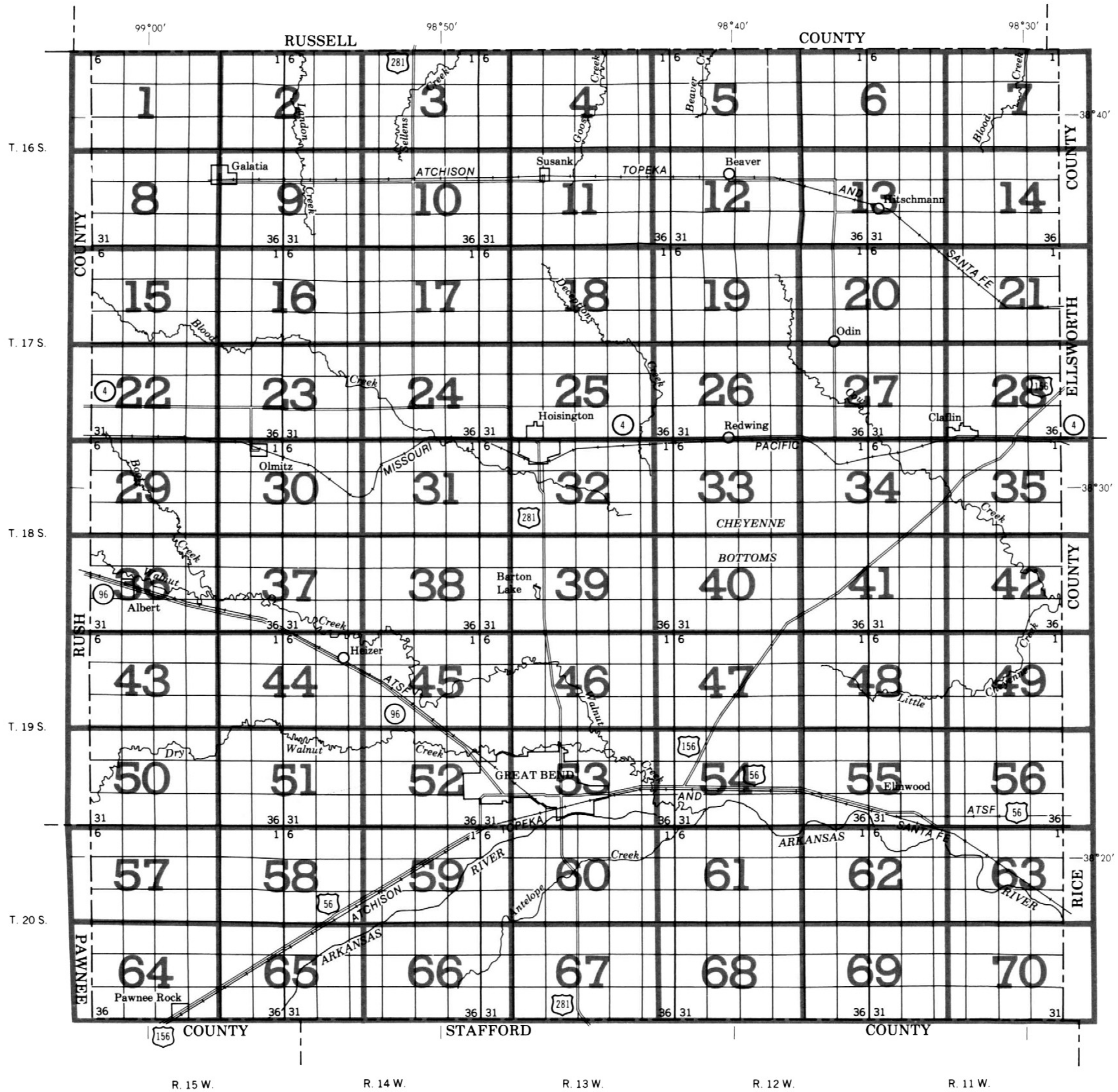
Compiled 1981

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

N



INDEX TO MAP SHEETS
BARTON COUNTY, KANSAS

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

SYMBOL	NAME
Aa	Attica loamy fine sand, 1 to 4 percent slopes
Ba	Bridgeport silt loam
Ca	Canadian fine sandy loam
Cb	Carwile fine sandy loam
Cr	Crete silt loam
Dt	Dillwyn-Tivoli complex, 0 to 15 percent slopes
Dw	Drummond silt loam
Fa	Farnum fine sandy loam
Fb	Farnum loam
Gb	Geary silt loam, 1 to 3 percent slopes
Gc	Geary silt loam, 3 to 7 percent slopes
Hb	Harney silt loam, 1 to 4 percent slopes
Ho	Holdrege silt loam, 1 to 3 percent slopes
Hr	Hord silt loam
Ka	Kaski loam
La	Lancaster-Hedville complex, 3 to 15 percent slopes
Na	Naron fine sandy loam, 0 to 3 percent slopes
Nb	Ness silty clay
Nc	New Cambria silty clay loam
Nw	Nibson-Wakeen silt loams, 3 to 15 percent slopes
Pa	Platte fine sandy loam
Pd	Pratt loamy fine sand, undulating
Pr	Pratt loamy fine sand, rolling
Ps	Pratt-Carwile loamy fine sands, 0 to 5 percent slopes
Pt	Pratt-Tivoli loamy fine sands, rolling
Ra	Roxbury silt loam, flooded
Ta	Tabler silt loam
Tb	Tabler-Drummond silt loams
Tv	Tivoli fine sand, hilly
Ub	Uly silt loam, 3 to 6 percent slopes
Wa	Wakeen silt loam, 1 to 3 percent slopes
Wb	Wakeen silt loam, 3 to 6 percent slopes
Wc	Waldeck fine sandy loam
Za	Zenda loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

National, state or province

County or parish

Minor civil division

Reservation (national forest or park, state forest or park, and large airport)

Land grant

Limit of soil survey (label)

Field sheet matchline & neatline

AD HOC BOUNDARY (label)

Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

Divided (median shown if scale permits)

Other roads

Trail

ROAD EMBLEMS & DESIGNATIONS

Interstate — 79

Federal — 410

State — 52

County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

Without road

With road

With railroad

DAMS

Large (to scale)

Medium or small — water; w

PITS

Gravel pit

Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)

Church

School

Indian mound (label) — Indian Mound

Located object (label) — Tower

Tank (label) — GAS

Wells, oil or gas

Windmill

Kitchen midden

WATER FEATURES

DRAINAGE

Perennial, double line

Perennial, single line

Intermittent

Drainage end

Canals or ditches

Double-line (label) — CANAL

Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

Perennial — water; w

Intermittent — int; i

MISCELLANEOUS WATER FEATURES

Marsh or swamp

Spring

Well, artesian

Well, irrigation

Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — Za; Ba

ESCARPMENTS

Bedrock (points down slope)

Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

Blowout

Clay spot

Gravelly spot

Gumbo, slick or scabby spot (sodic)

Dumps and other similar non soil areas

Prominent hill or peak

Rock outcrop (includes sandstone and shale)

Saline spot

Sandy spot

Severely eroded spot

Slide or slip (tips point upslope)

Stony spot, very stony spot

SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 1

1

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 2

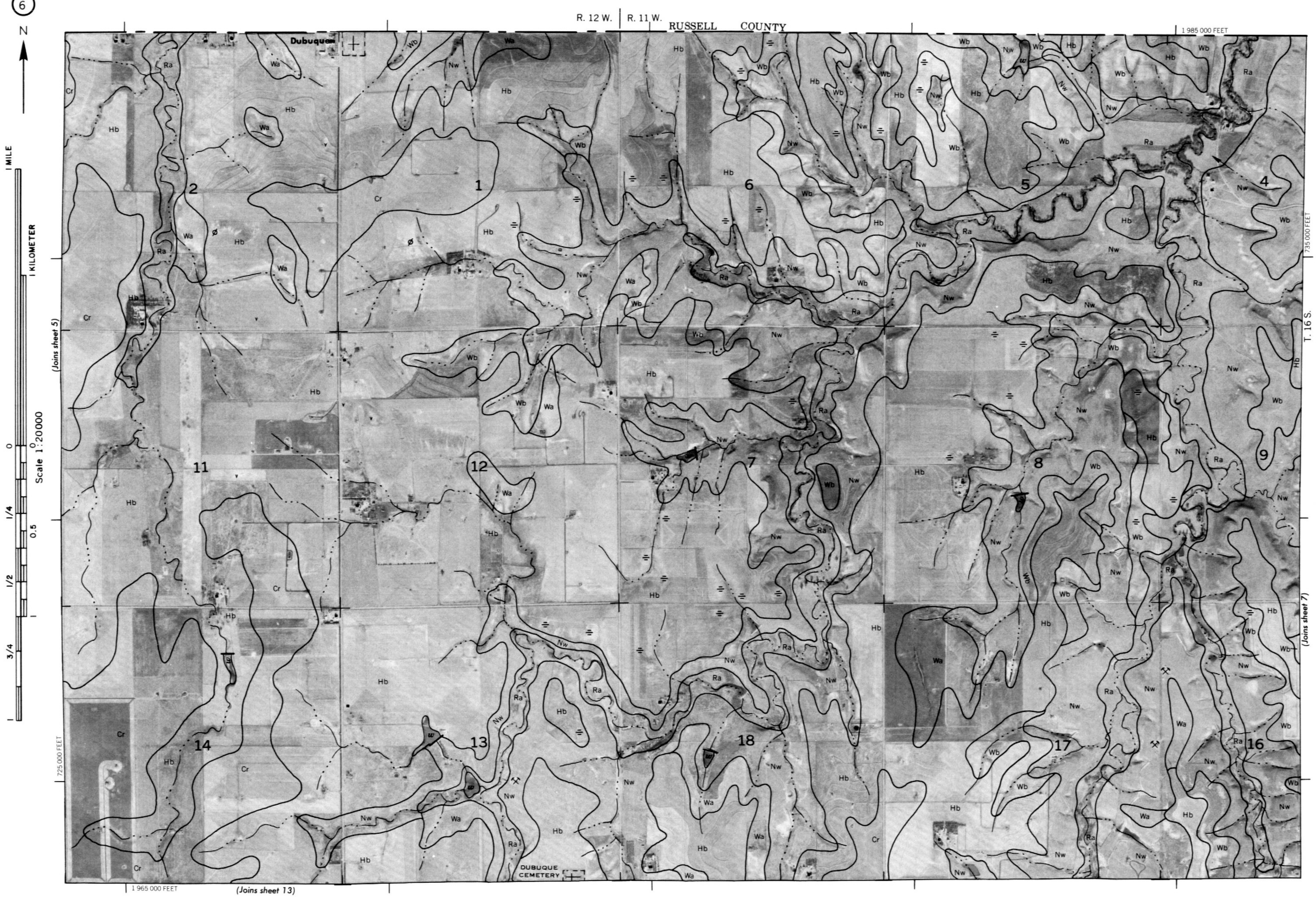

3
N
RUSSELL COUNTY
R. 14 W.
R. 13 W.
T. 16 S.
1 895 000 FEET
1 915 000 FEET
735 000 FEET
725 000 FEET
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
SCHNEIDER CEMETERY
Sellens Creek
281
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
Cr
Hb
Hr
Nw
Ra
Ub
Wa
Wb

4

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 4

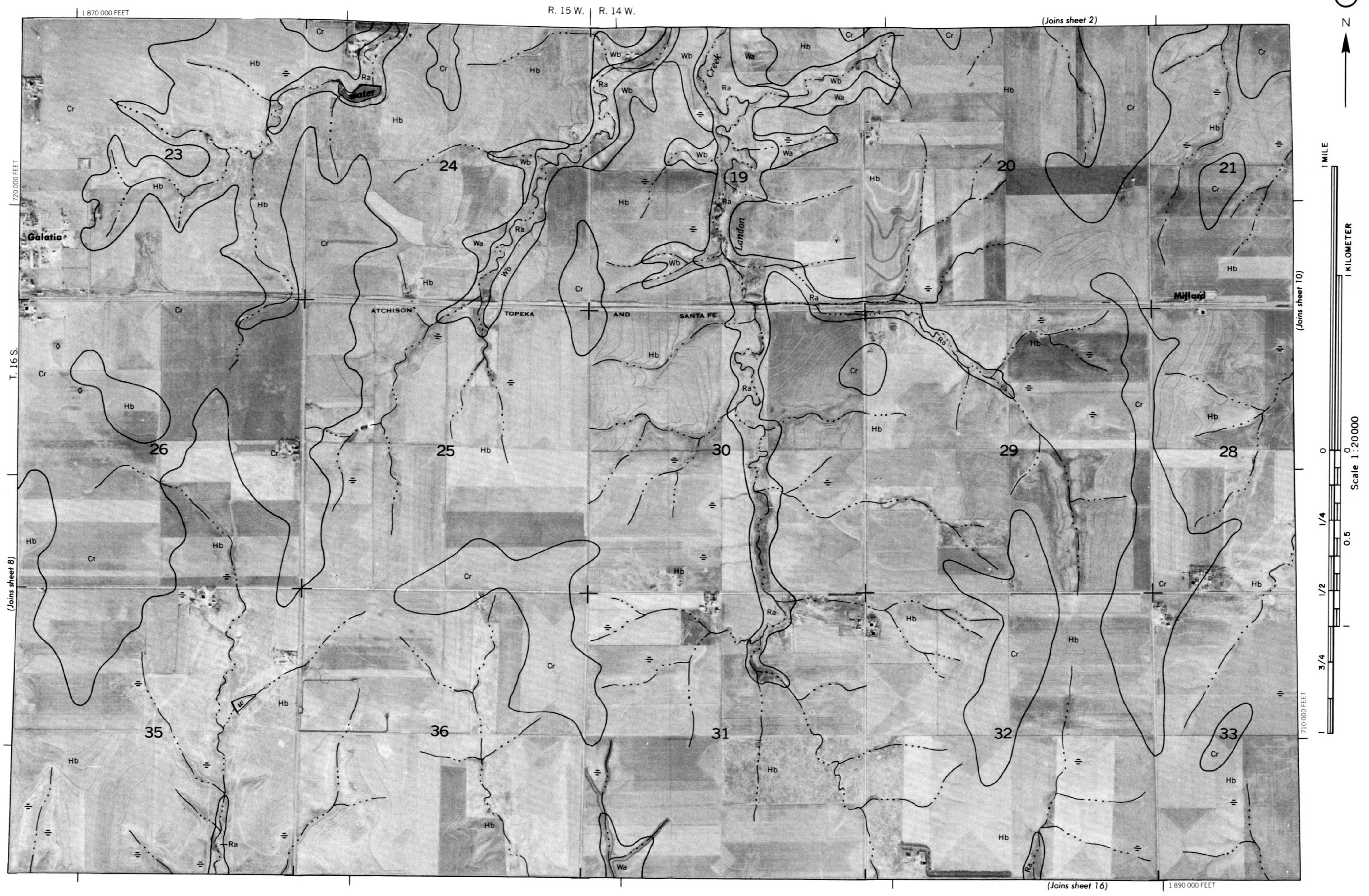

5
N
1 940 000 FEET
R. 13 W.
R. 12 W.
RUSSELL COUNTY
T. 16 S.
735 000 FEET
725 000 FEET
1 960 000 FEET
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
Beaver
Creek
ST JOSEPHS CEMETERY
PRESBYTERIAN CEMETERY
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18
Cr
Hb
Nw
Ra
Wa
Wb
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:20000

SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 6



SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 7

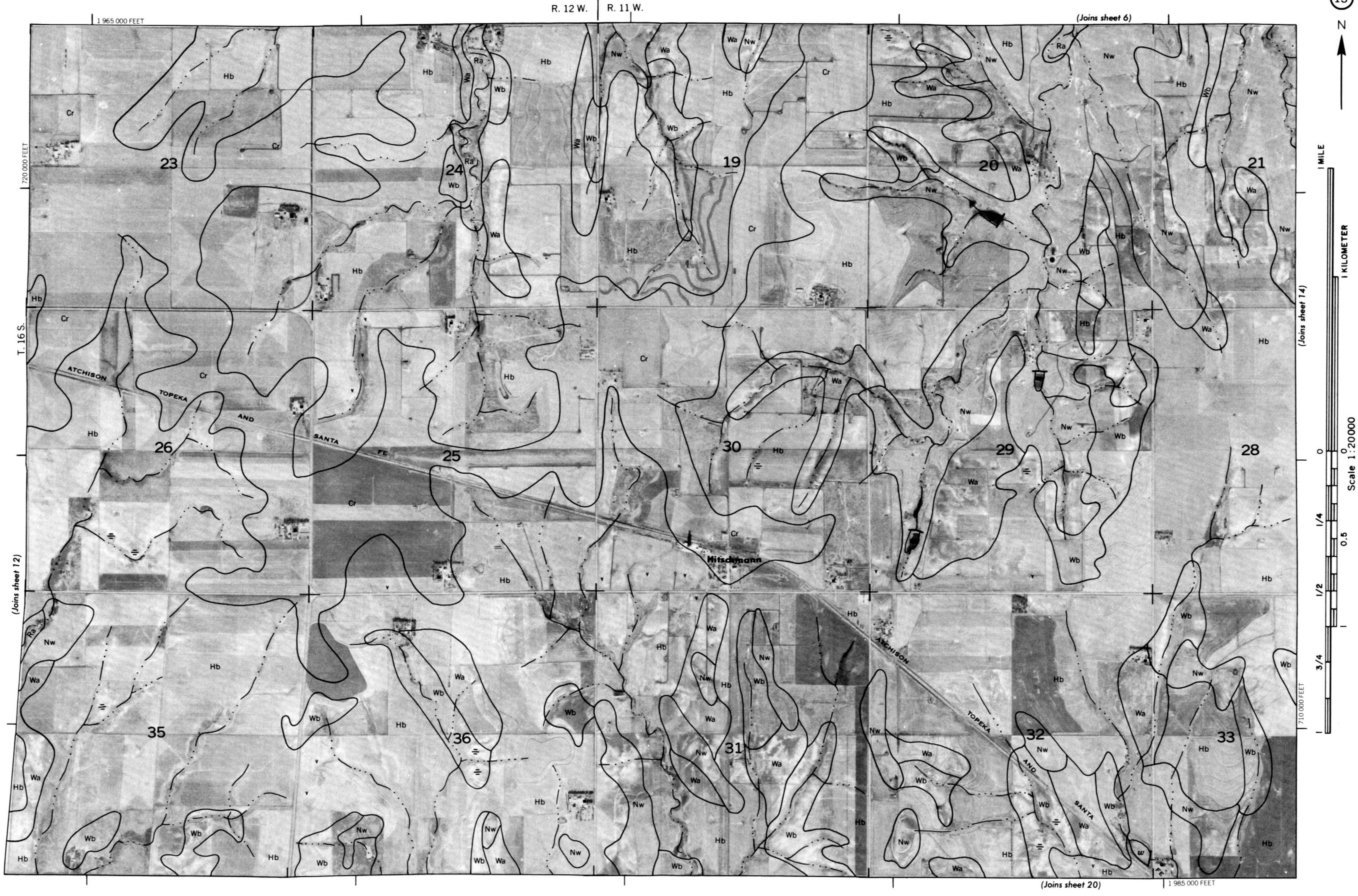

8
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 1)
R. 15 W.
1 865 000 FEET
FAIRVIEW CEMETERY
Galatia
720 000 FEET
T. 16 S.
(Joins sheet 9)
(Joins sheet 15)
1 850 000 FEET
710 000 FEET
RUSH COUNTY
19
20
21
22
30
29
28
27
31
32
33
34


9
N
1 870 000 FEET
R. 15 W.
R. 14 W.
(Joins sheet 2)
720 000 FEET
T. 16 S.
Galatia
Millard
ATCHISON
TOPEKA
AND
SANTA FE
Creek
Landon
Water
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 16)
710 000 FEET
1 890 000 FEET
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5

SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 10

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 11

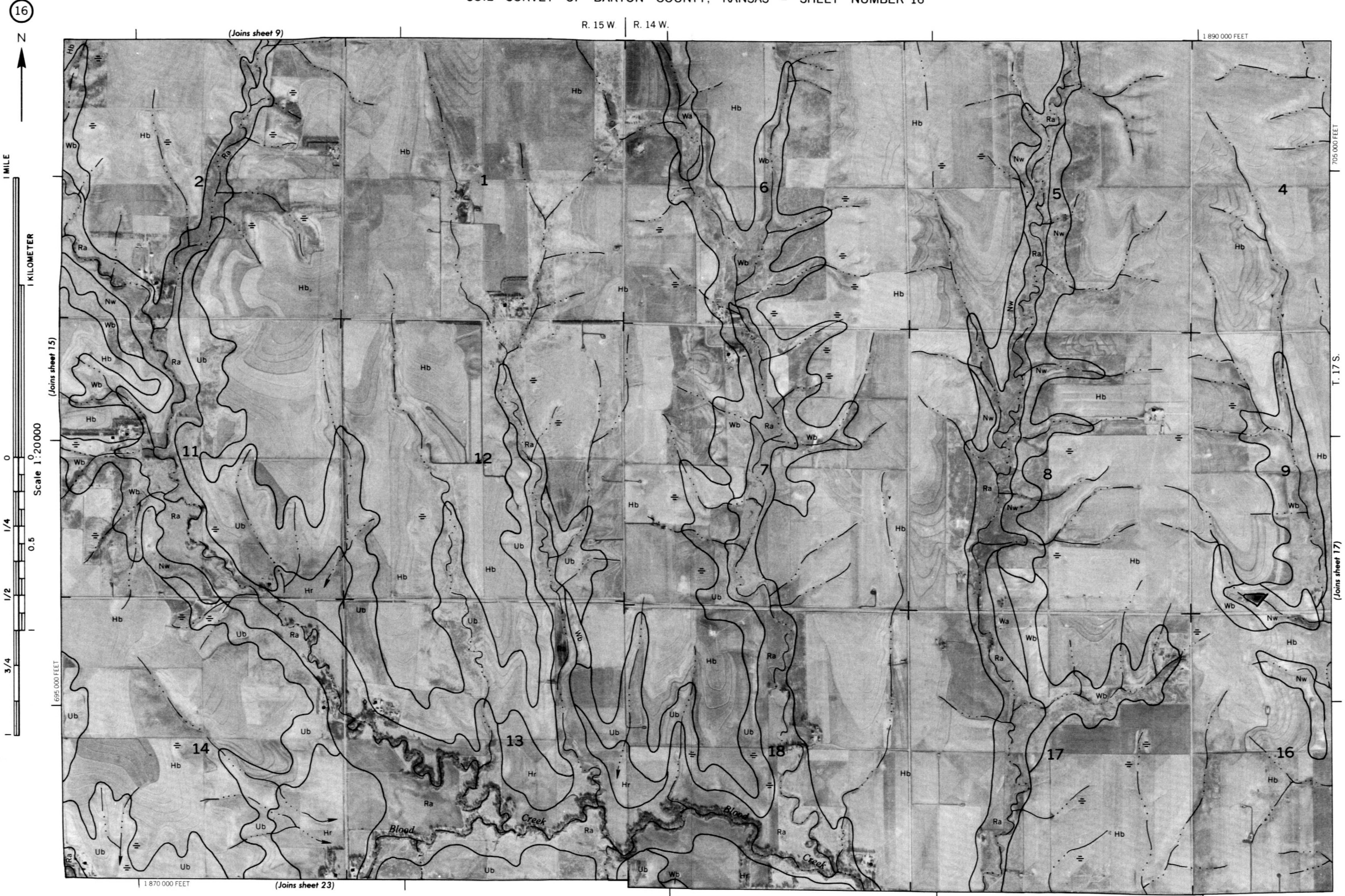

N
R. 13 W.
R. 12 W.
(Joins sheet 5)
1 960 000 FEET
720 000 FEET
T. 16 S.
(Joins sheet 13)
(Joins sheet 11)
(Joins sheet 19)
1 940 000 FEET
710 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
FRIENDS CEMETERY
Beaver
ATCHISON
TOPEKA
AND
SANTA FE
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34
Hb
Cr
Wa
Wb
Nw
Ra
Gb
Gc


R. 12 W.
R. 11 W.
1 965 000 FEET
(Joins sheet 6)
720 000 FEET
T. 16 S.
(Joins sheet 12)
(Joins sheet 14)
710 000 FEET
(Joins sheet 20)
1 985 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
ATCHISON TOPEKA AND SANTA FE
Hitschmann
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
Cr
Hb
Nw
Ra
Wa
Wb

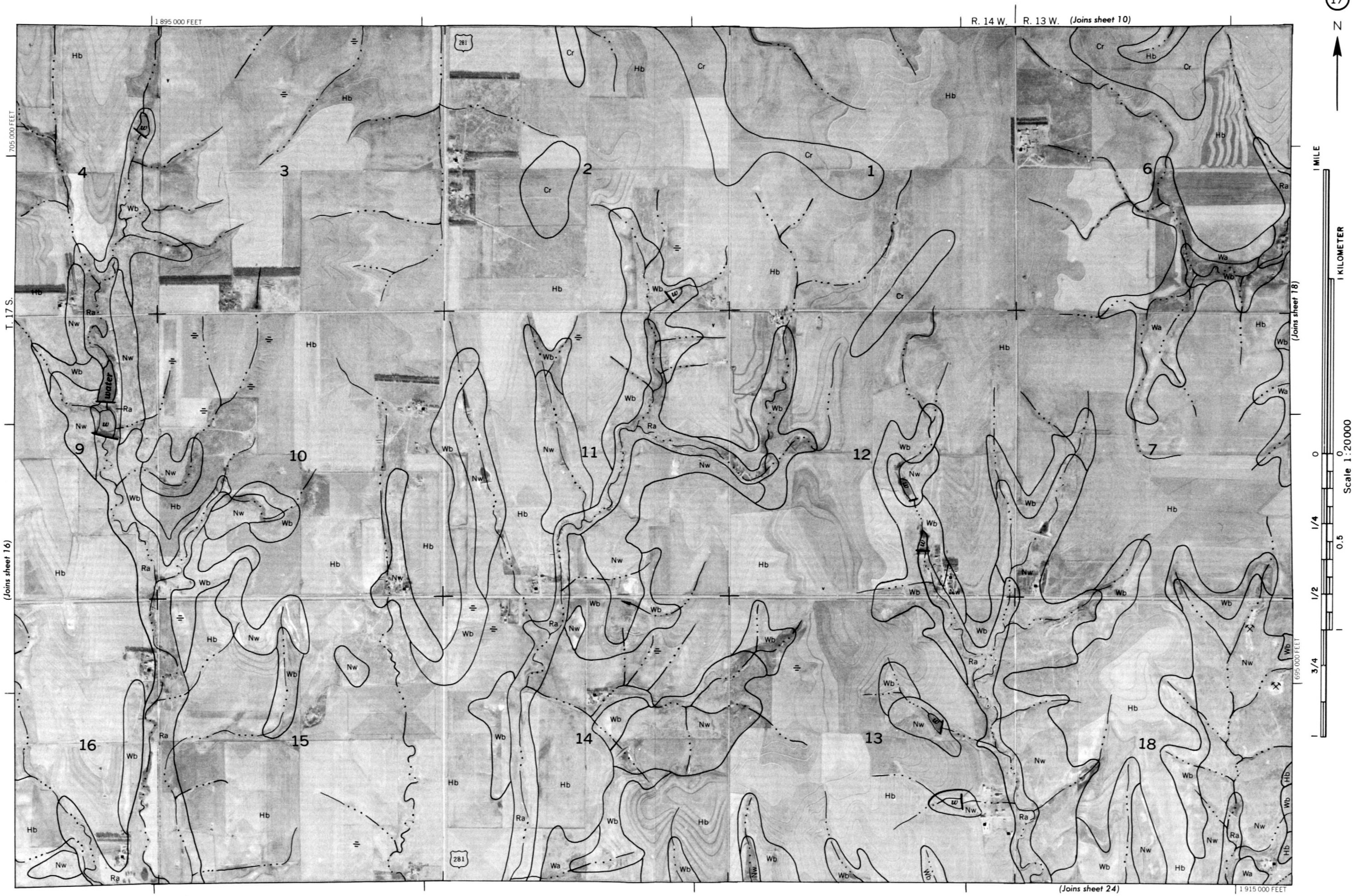

14
N
(Joins sheet 7)
R. 11 W.
2 010 000 FEET
720 000 FEET
T. 16 S.
(Joins sheet 13)
710 000 FEET
1 990 000 FEET
(Joins sheet 21)
BETHEL CEMETERY
ELLSWORTH COUNTY
21
22
23
24
25
26
27
28
33
34
35
36
Hb
Nw
Wa
Wb
Ra
Cr
Gc
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 15

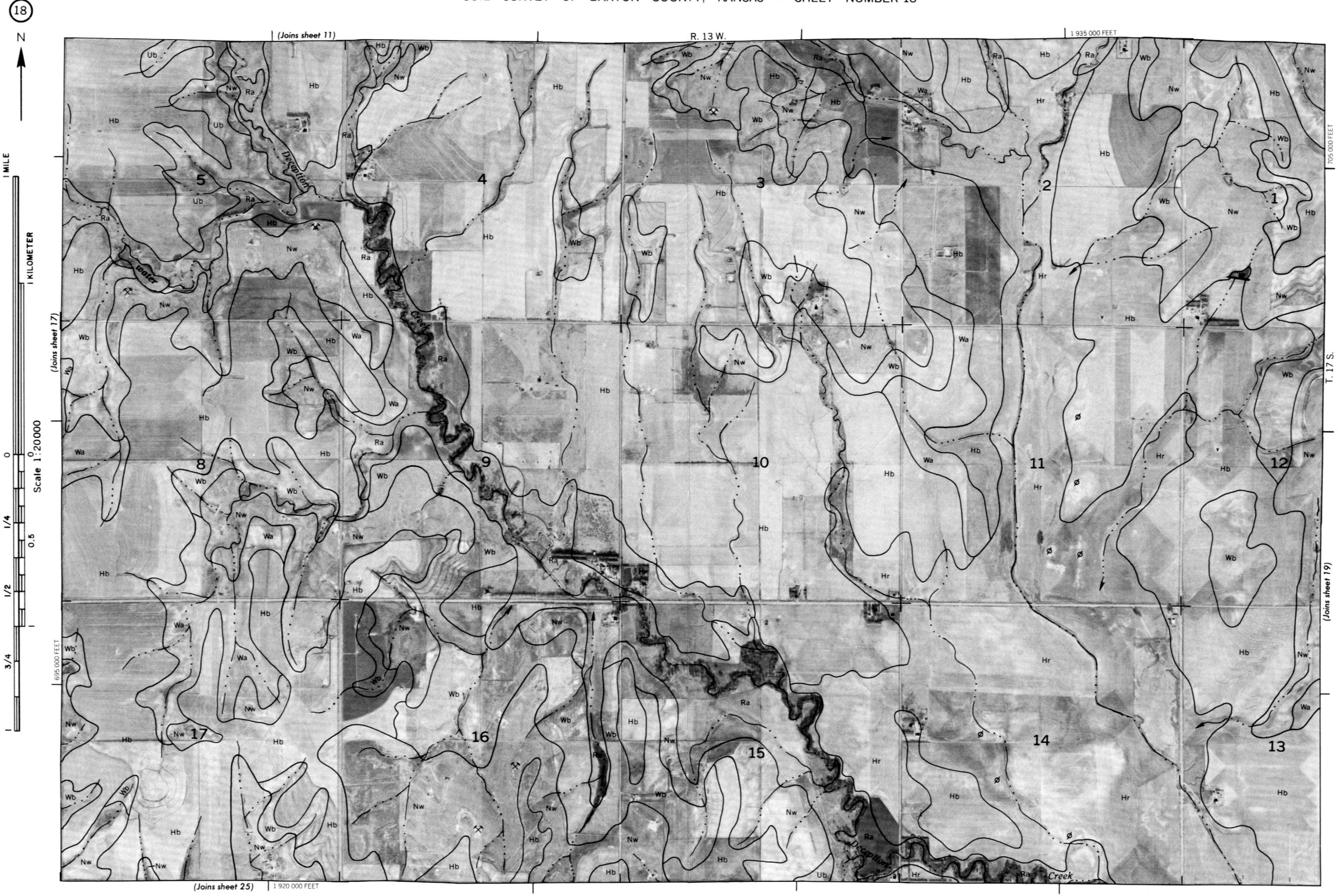
SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 16

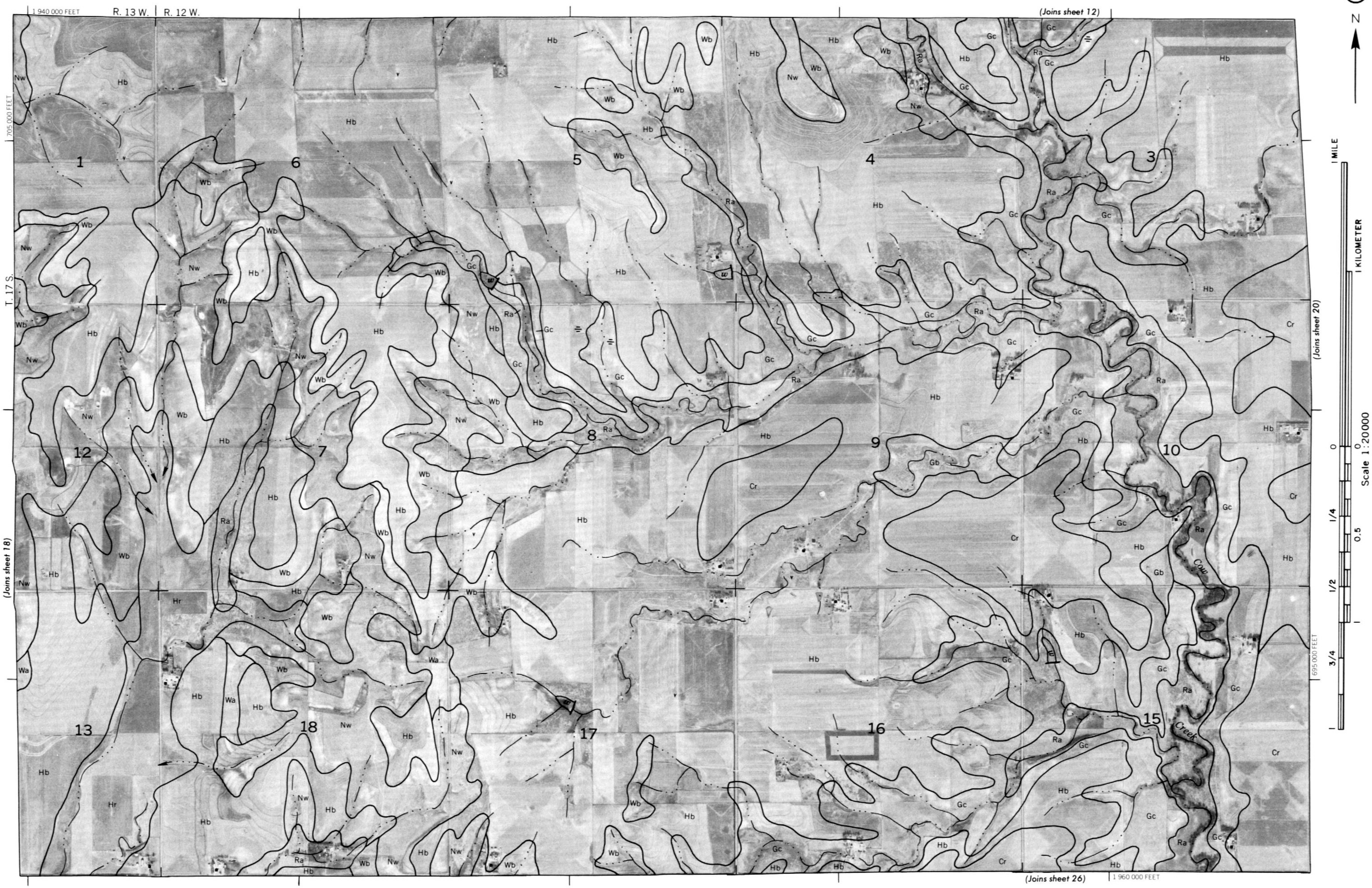


SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 17



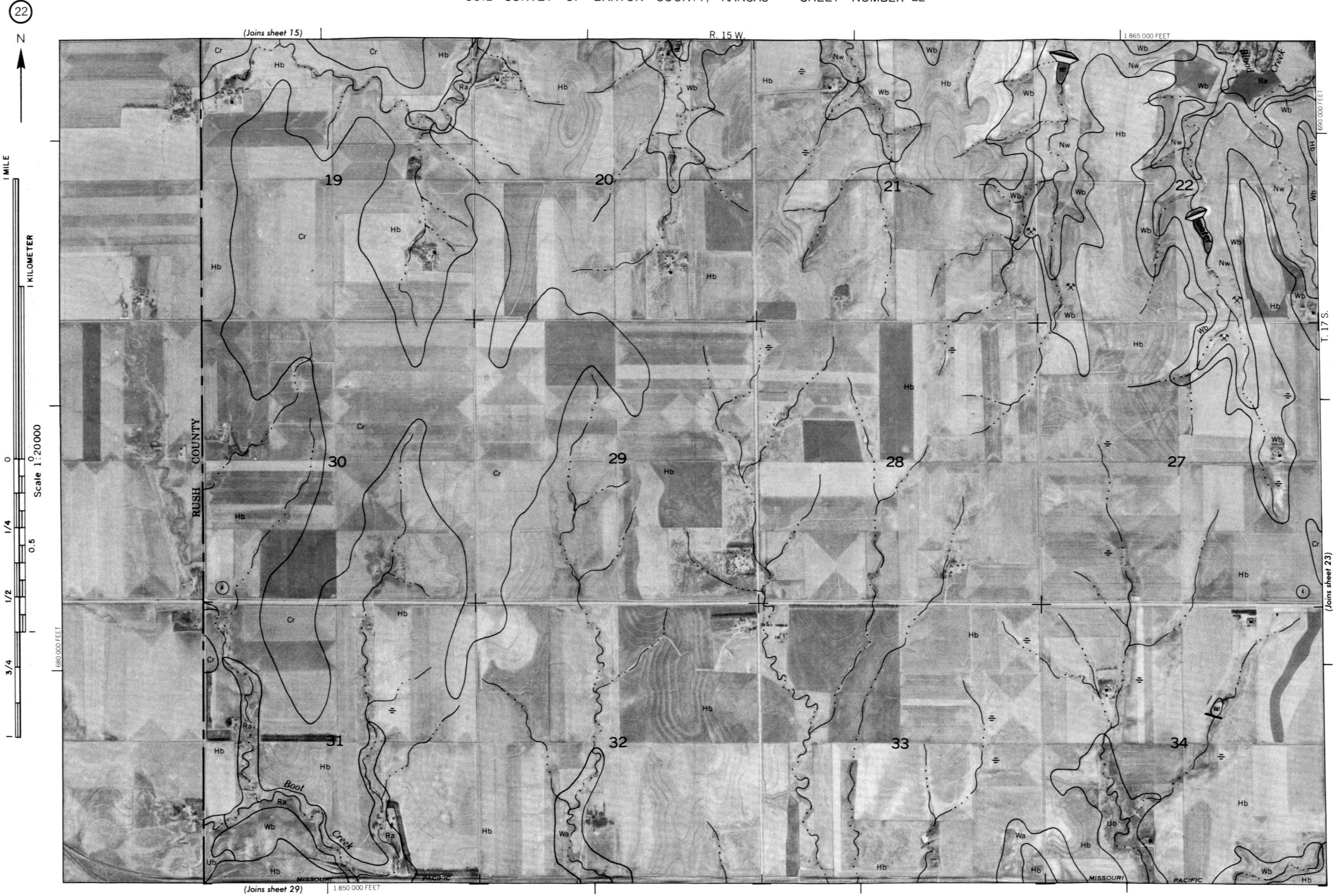
SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 18




1 940 000 FEET
R. 13 W.
R. 12 W.
(Joins sheet 12)
705 000 FEET
T. 17 S.
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 26)
695 000 FEET
1 960 000 FEET
Cow Creek
N
1 MILE
1 KILOMETER
Scale 1:20000

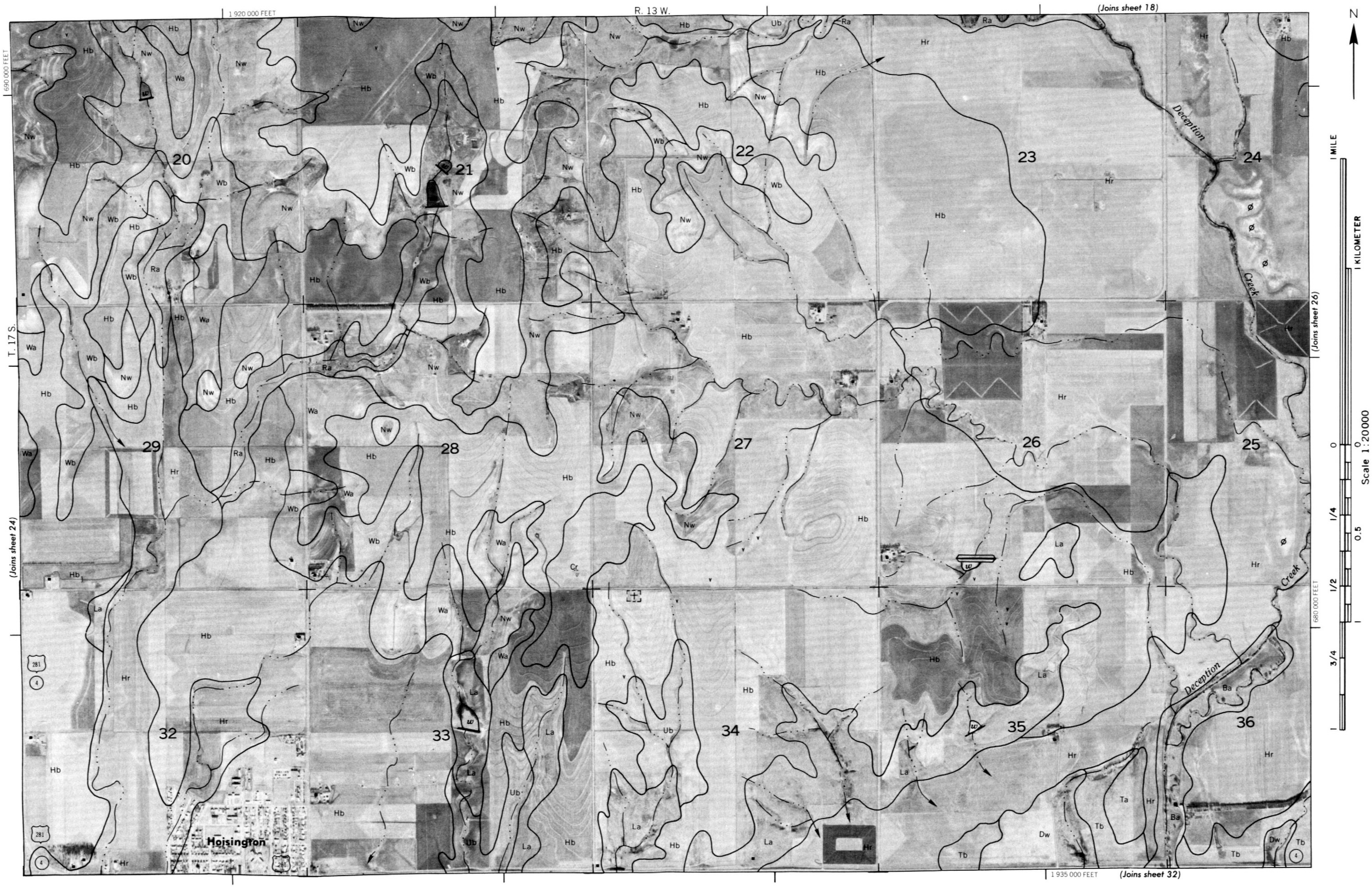
SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 20


21
N
1 990 000 FEET
R. 11 W.
(Joins sheet 14)
705 000 FEET
T. 17 S.
(Joins sheet 20)
(Joins sheet 28)
695 000 FEET
2 010 000 FEET
ATCHISON
TOPEKA
AND
SANTA
FE
Farhman
ELLSWORTH COUNTY
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5

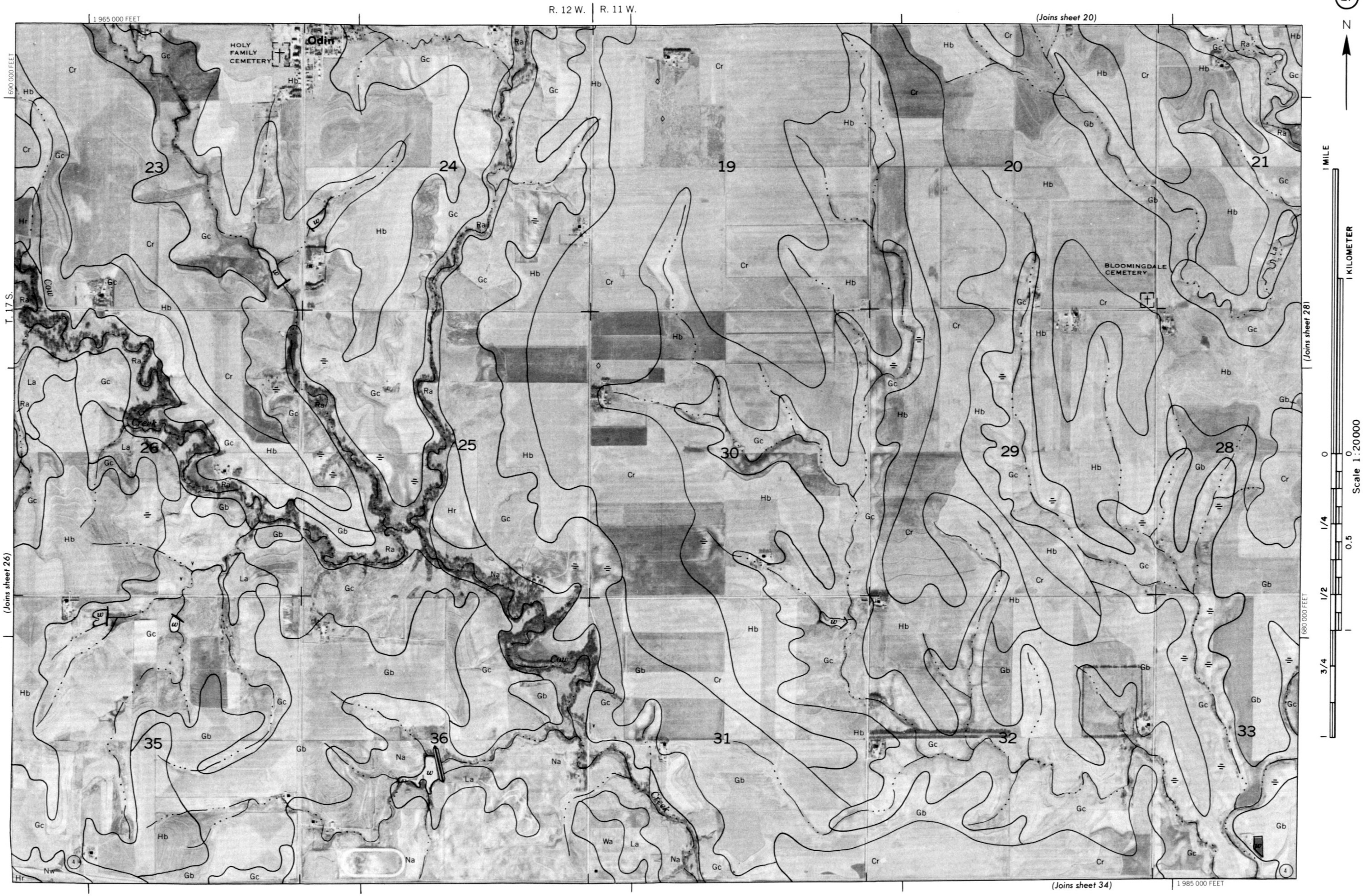

22
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 15)
R. 15 W.
1 865 000 FEET
690 000 FEET
T. 17 S.
(Joins sheet 23)
(Joins sheet 29)
1 850 000 FEET
680 000 FEET
RUSH COUNTY
Blood Creek
Boot Creek
MISSOURI
PACIFIC
19
20
21
22
30
29
28
27
31
32
33
34
Cr
Hb
Ra
Wb
Nw
Ub
Wa


23
N
1 870 000 FEET
R. 15 W.
R. 14 W.
(Joins sheet 16)
690 000 FEET
T. 17 S.
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
680 000 FEET
1 890 000 FEET
Blood Creek
BOYLE CEMETERY
ST ANNES CEMETERY
MISSOURI PACIFIC
water
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5


24
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 17)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
R. 14 W.
R. 13 W.
T. 17 S.
1 915 000 FEET
690 000 FEET
680 000 FEET
1 895 000 FEET
OLIVER CEMETERY
Blood Creek
MISSOURI PACIFIC
281
4
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36
Ba
Cr
Hb
Hr
La
Nc
Nw
Ra
Wa
Wb

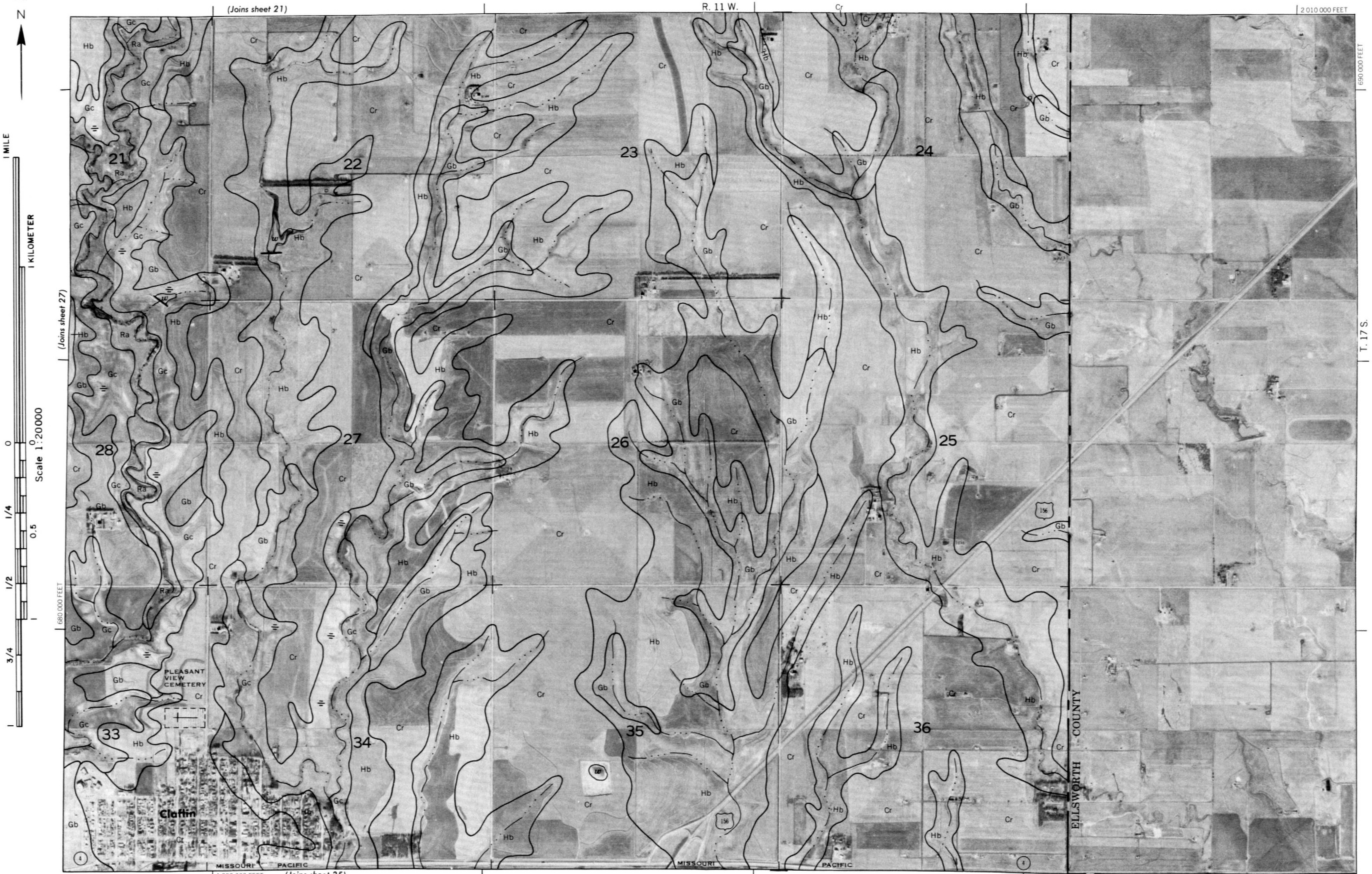

25
N
1 920 000 FEET
R. 13 W.
(Joins sheet 18)
690 000 FEET
T. 17 S.
(Joins sheet 24)
(Joins sheet 26)
680 000 FEET
1 935 000 FEET
(Joins sheet 32)
Deception Creek
Deception Creek
Hoisington
281
4
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
Hb
Nw
Wa
Wb
Ra
Hr
La
Ub
Cr
Ba
Dw
Ta
Tb
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000


26
N
R. 13 W.
R. 12 W.
(Joins sheet 19)
1 960 000 FEET
690 000 FEET
(Joins sheet 25)
T. 17 S.
(Joins sheet 27)
680 000 FEET
1 940 000 FEET
(Joins sheet 33)
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34
Deception Creek
Cow Creek
water
Red Wing
MISSOURI PACIFIC
Hb
Hr
Gc
Gb
Nw
Wb
Ra
Cr
La
Ub
Tb
Ta
Dw
Ba


1 965 000 FEET
R. 12 W.
R. 11 W.
(Joins sheet 20)
690 000 FEET
HOLY FAMILY CEMETERY
Odin
BLOOMINGDALE CEMETERY
T. 17 S.
Cow Creek
(Joins sheet 28)
(Joins sheet 26)
680 000 FEET
(Joins sheet 34)
1 985 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

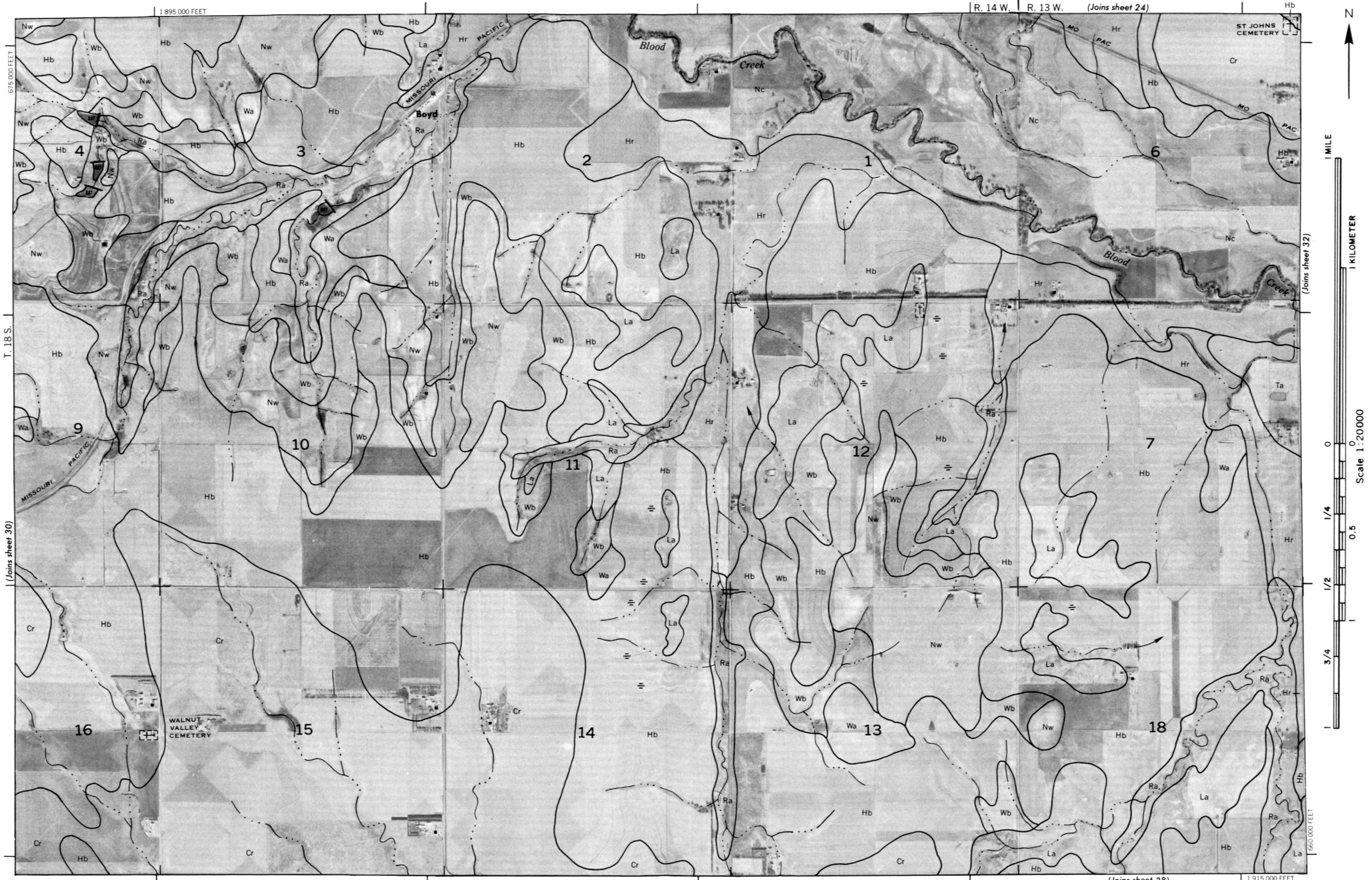
28

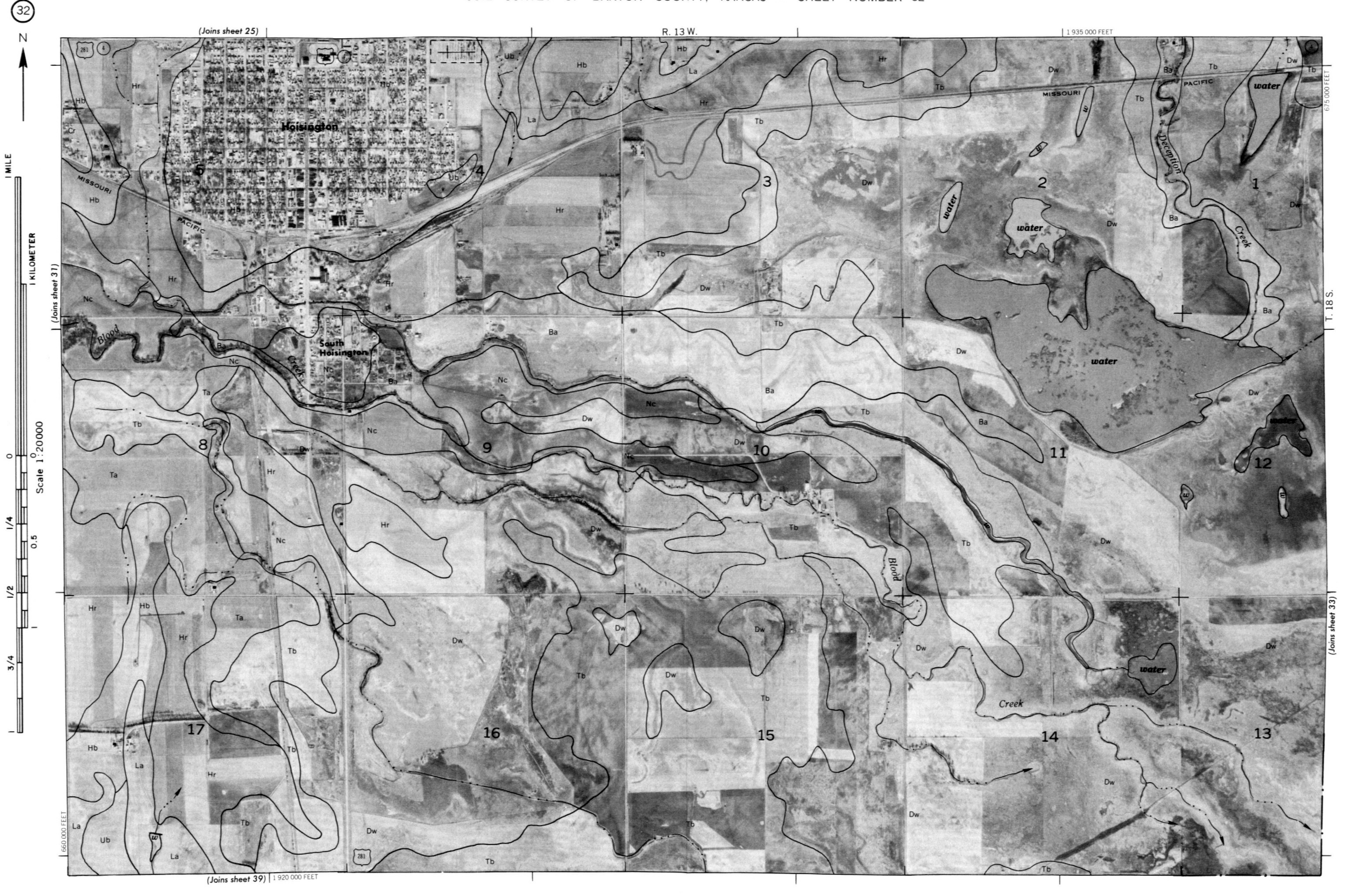
SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 28




29
N
R. 15 W.
T. 18 S.
1 850 000 FEET
1 865 000 FEET
675 000 FEET
660 000 FEET
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
MISSOURI PACIFIC
MO-PAC
RUSH COUNTY
Boot Creek
ST ANTHONYS CEMETERY
Scale 1:20000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
3 4 5 6 7 8 9 10 15 16 17 18
Hb Ub Ra Wa Wb Nw Cr Nc W

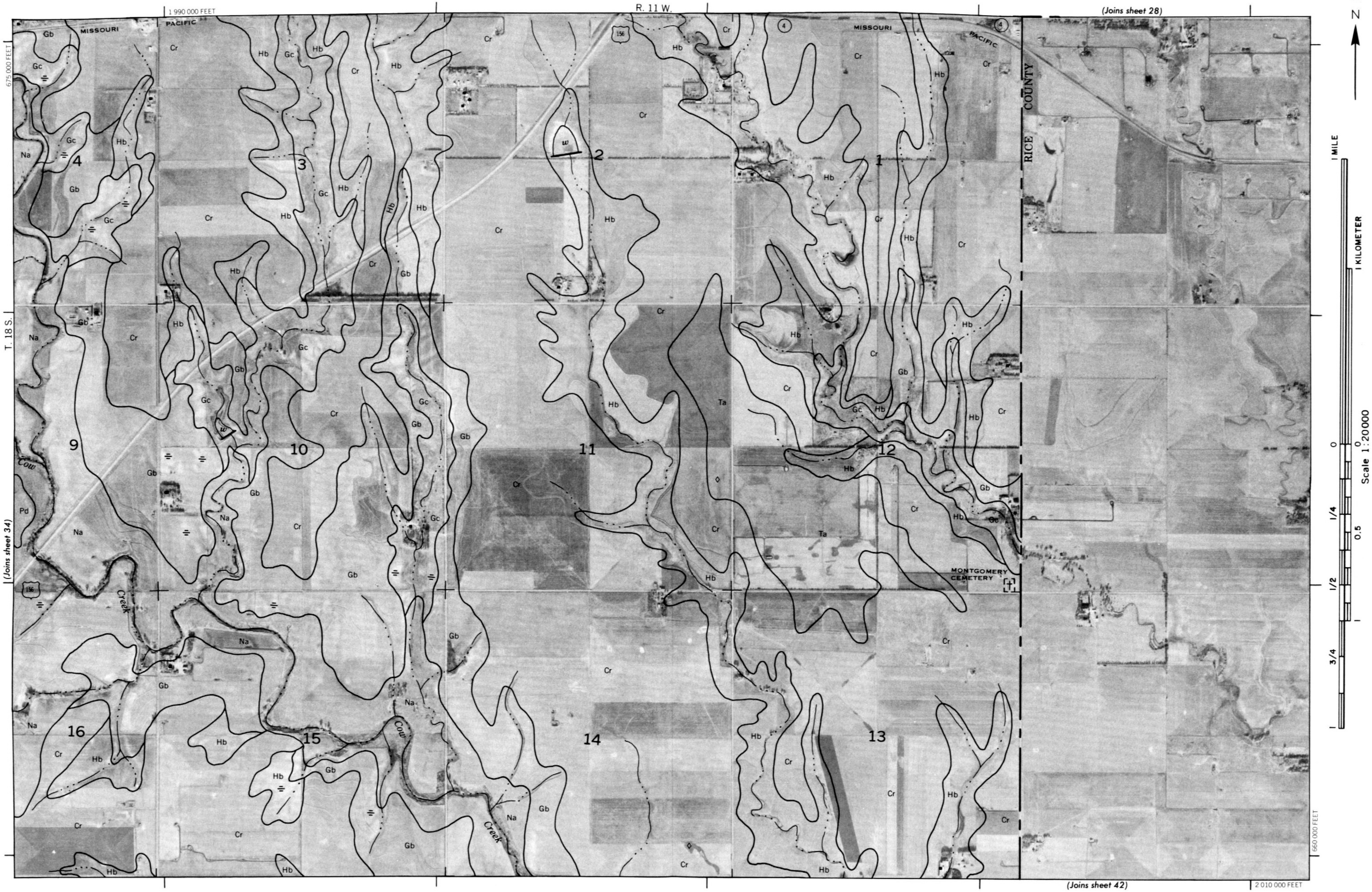
SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 30


31
N
R. 14 W.
R. 13 W.
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 30)
T. 18 S.
1 895 000 FEET
1 915 000 FEET
675 000 FEET
660 000 FEET
ST JOHNS CEMETERY
WALNUT VALLEY CEMETERY
Boyd
Blood Creek
MISSOURI PACIFIC
MO PAC
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5


32
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 25)
R. 13 W.
1 935 000 FEET
675 000 FEET
T. 18 S.
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
1 920 000 FEET
660 000 FEET
Hoisington
South Hoisington
MISSOURI
PACIFIC
Blood
Creek
Deception
water
w
281
Hb
Hr
Cr
Nc
Ba
Ta
Tb
Dw
La
Ub
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

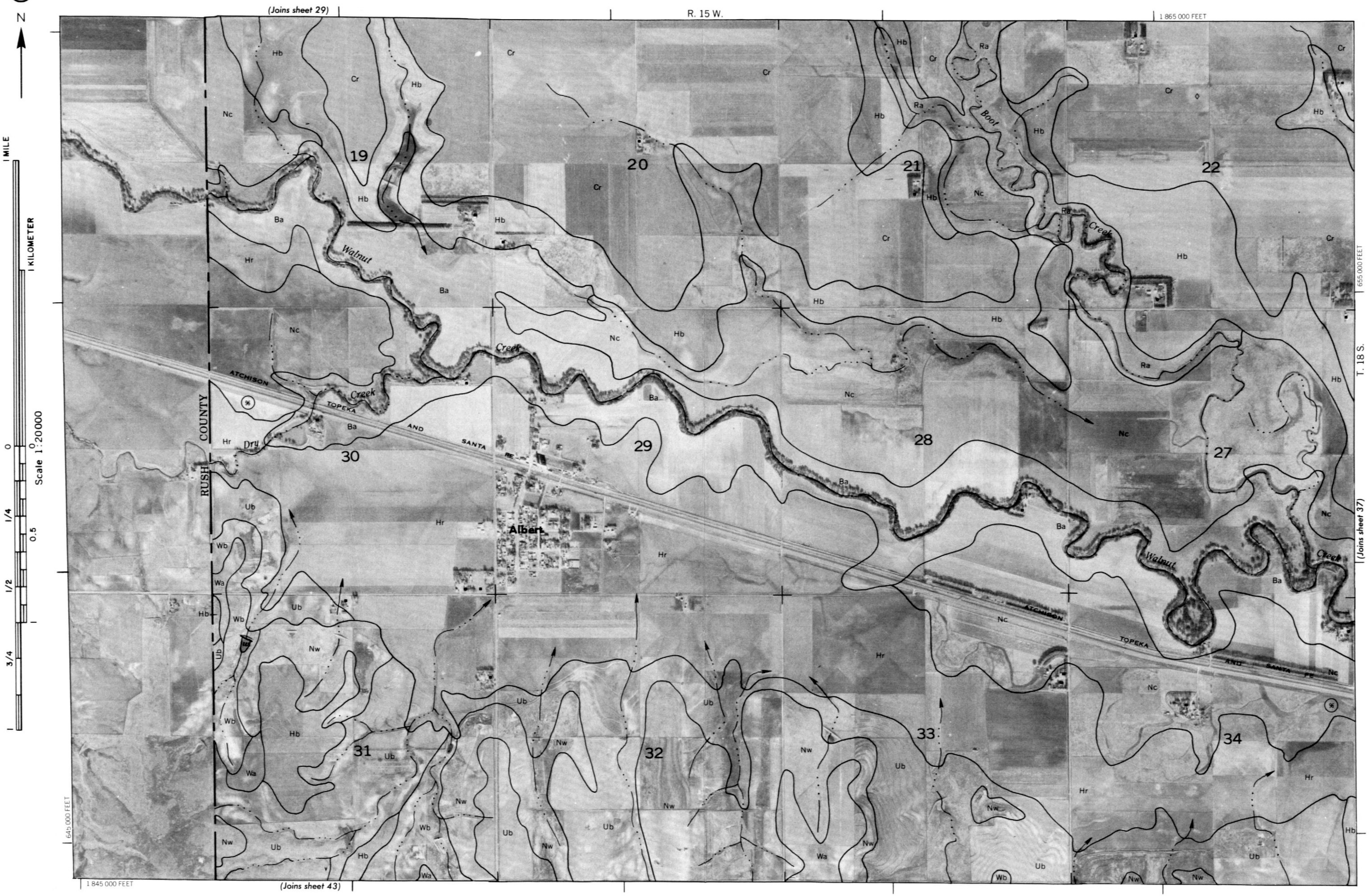

1 940 000 FEET
R. 13 W.
R. 12 W.
(Joins sheet 26)
N
MISSOURI
PACIFIC
MO
PAC
675 000 FEET
T. 18 S.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 40)
1 960 000 FEET
660 000 FEET
water
water
water
CHEYENNE
BOTTOMS
STATE
WATERFOWL
MANAGEMENT
REFUGE
Tb
Dw
Hr
Ta
Ba
1
3
4
5
6
7
8
9
12
13
17
18
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:20000

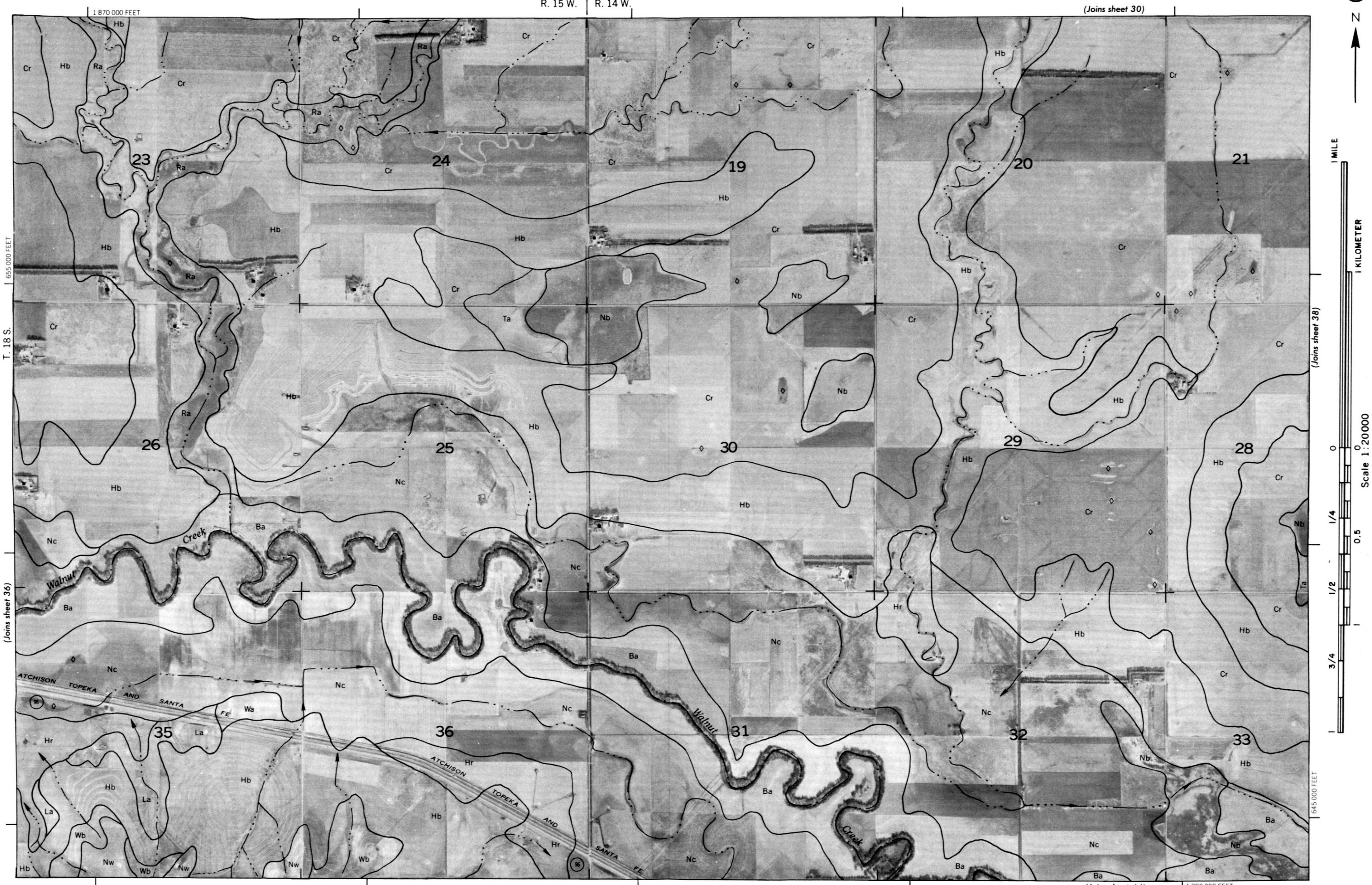

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
R. 12 W.
R. 11 W.
T. 18 S.
1 985 000 FEET
675 000 FEET
1 965 000 FEET
660 000 FEET
MISSOURI PACIFIC
Cow Creek
CHEYENNE BOTTOMS STATE WATERFOWL MANAGEMENT REFUGE
water
156


35
N
(Joins sheet 28)
R. 11 W.
1 990 000 FEET
675 000 FEET
T. 18 S.
(Joins sheet 34)
(Joins sheet 42)
2 010 000 FEET
660 000 FEET
MISSOURI PACIFIC
RICE COUNTY
MONTGOMERY CEMETERY
Cow Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

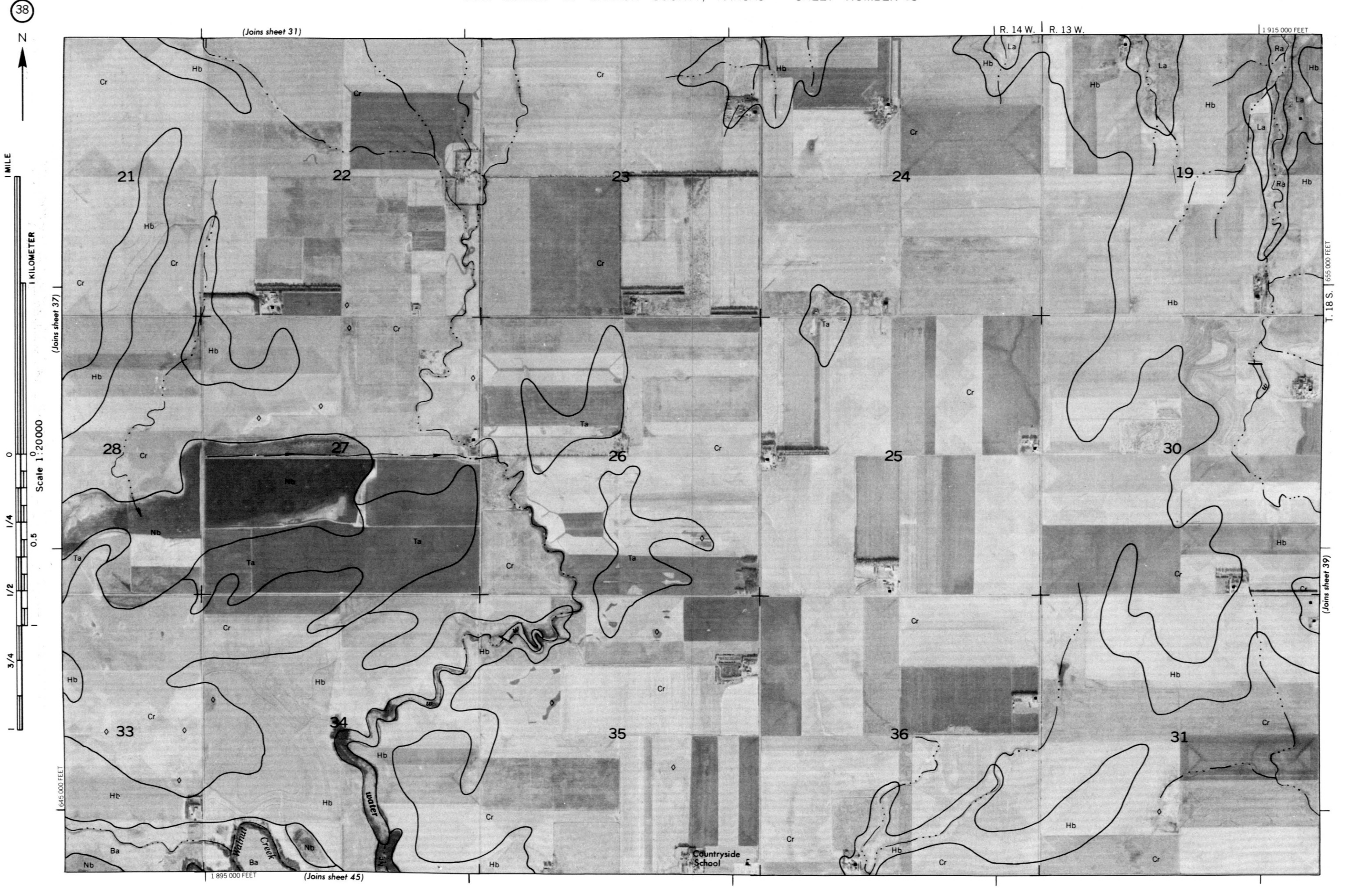
SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 36

36



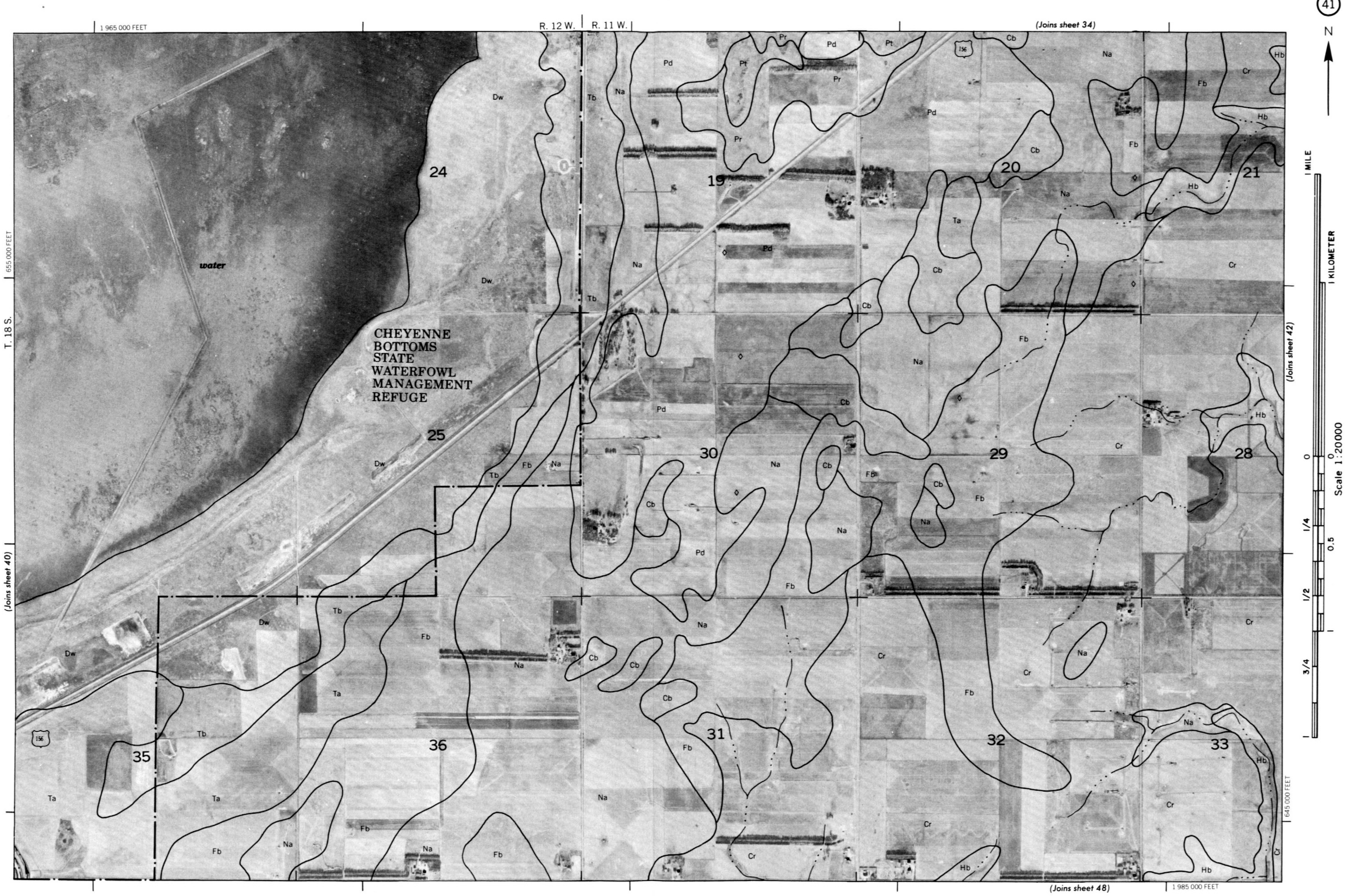


R. 15 W.
R. 14 W.
1 870 000 FEET
(Joins sheet 30)
(Joins sheet 38)
(Joins sheet 36)
(Joins sheet 44)
1 890 000 FEET
655 000 FEET
645 000 FEET
T. 18 S.
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
Walnut Creek
ATCHISON TOPEKA AND SANTA FE
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

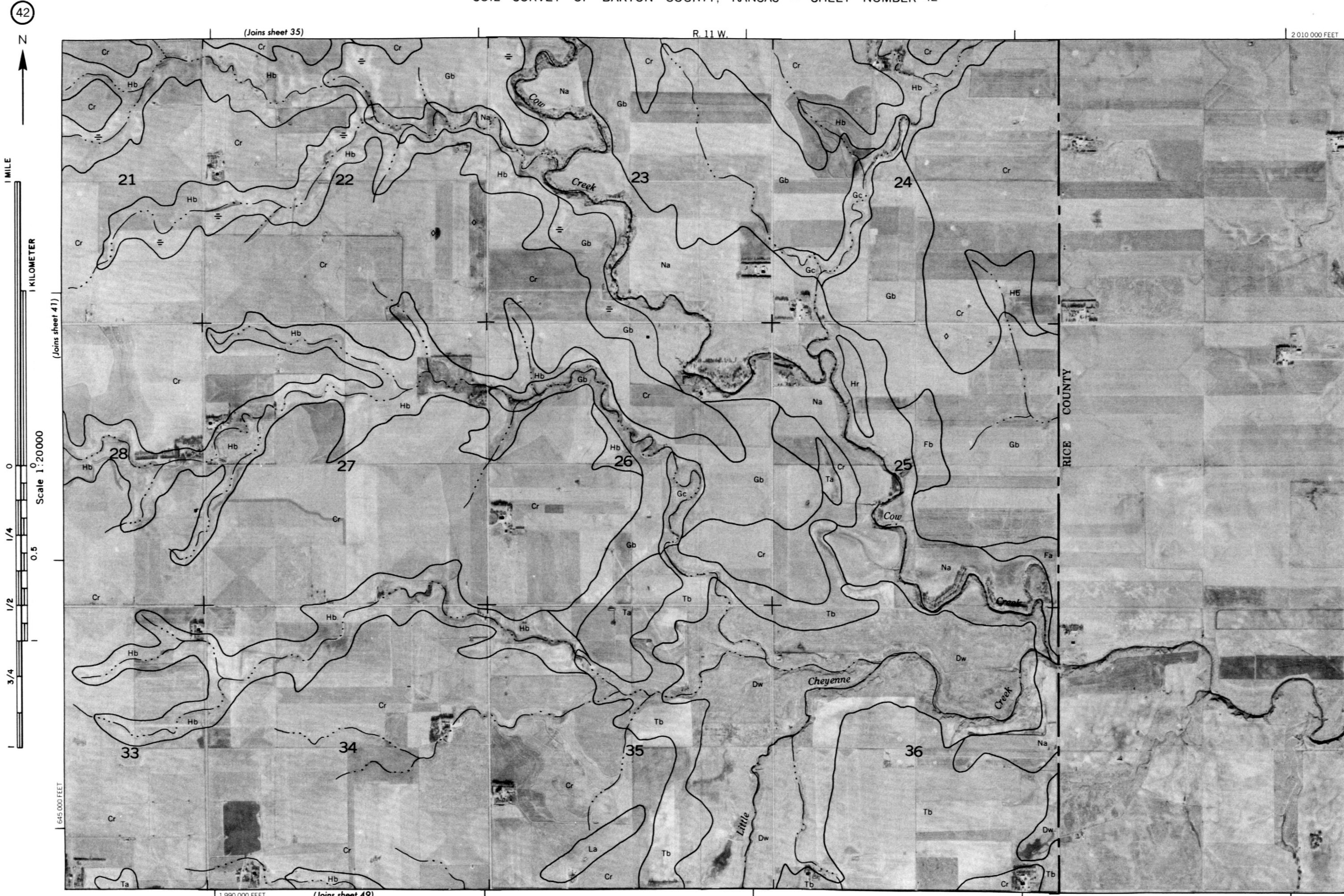

38
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 45)
R. 14 W.
R. 13 W.
T. 18 S.
1 915 000 FEET
655 000 FEET
645 000 FEET
1 895 000 FEET
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36
Walnut Creek
water
Countryside School
Cr
Hb
La
Ra
Ta
Nb
Ba


39
N
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
1 920 000 FEET
1 940 000 FEET
655 000 FEET
645 000 FEET
R. 13 W.
T. 18 S.
water
Barton Lake
CHEYENNE
BOTTOMS
STATE
WATERFOWL
MANAGEMENT
REFUGE
Cheyenne Bottoms Canal
Canal
Bottoms
Cheyenne
HILLCREST
MEMORIAL
PARK
CEMETERY
281
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1 MILE
1 KILOMETER
Scale 1:20000


40
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0
0.5
R. 13 W.
R. 12 W.
(Joins sheet 33)
1 960 000 FEET
655 000 FEET
T. 18 S.
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 47)
1 940 000 FEET
645 000 FEET
Dw
24
water
Cheyenne Bottoms Canal
36
31
33
34
CHEYENNE BOTTOMS STATE WATERFOWL MANAGEMENT REFUGE
Tb
Ta
Hr
156
w

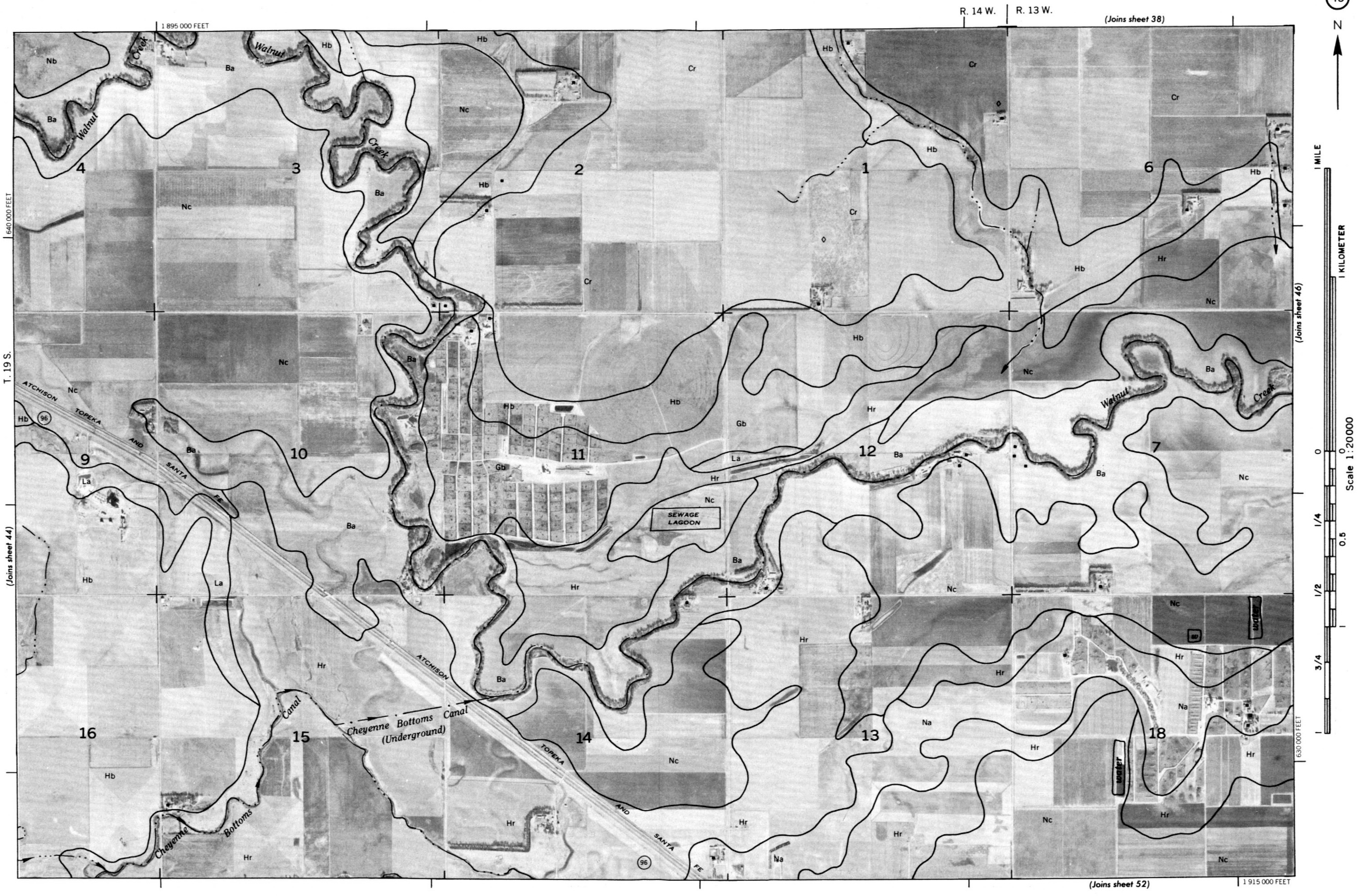

41
N
1 965 000 FEET
R. 12 W.
R. 11 W.
(Joins sheet 34)
(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 40)
655 000 FEET
645 000 FEET
1 985 000 FEET
T. 18 S.
water
CHEYENNE
BOTTOMS
STATE
WATERFOWL
MANAGEMENT
REFUGE
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0
0.5

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 42



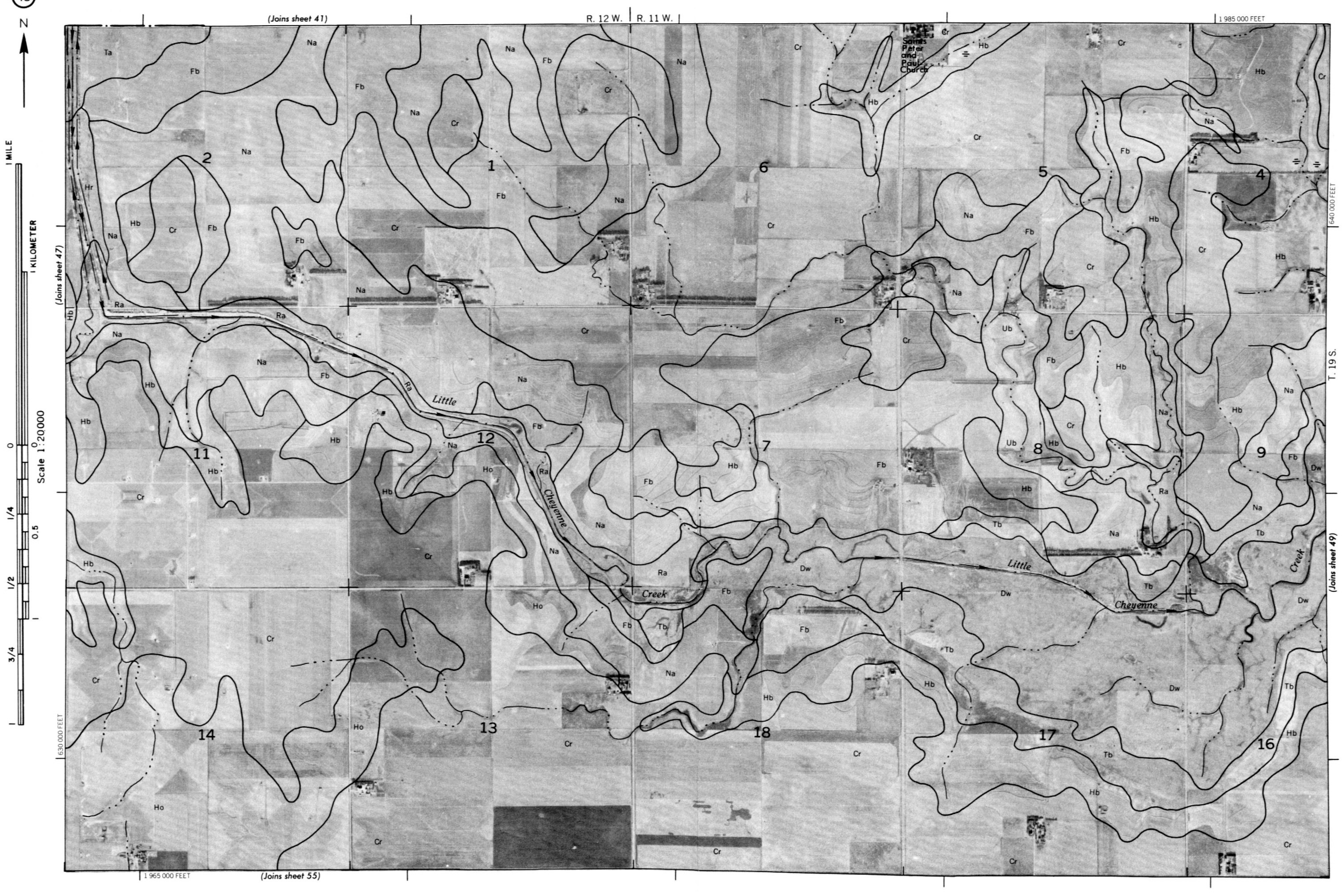

43
N
R. 15 W.
(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 50)
1 845 000 FEET
1 865 000 FEET
640 000 FEET
630 000 FEET
T. 19 S.
RUSH COUNTY
PATTERSON CEMETERY
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
6
5
4
3
7
8
9
10
18
17
16
15
Ub
Nw
Hb
Wa
Wb
Ra
Cr

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 44

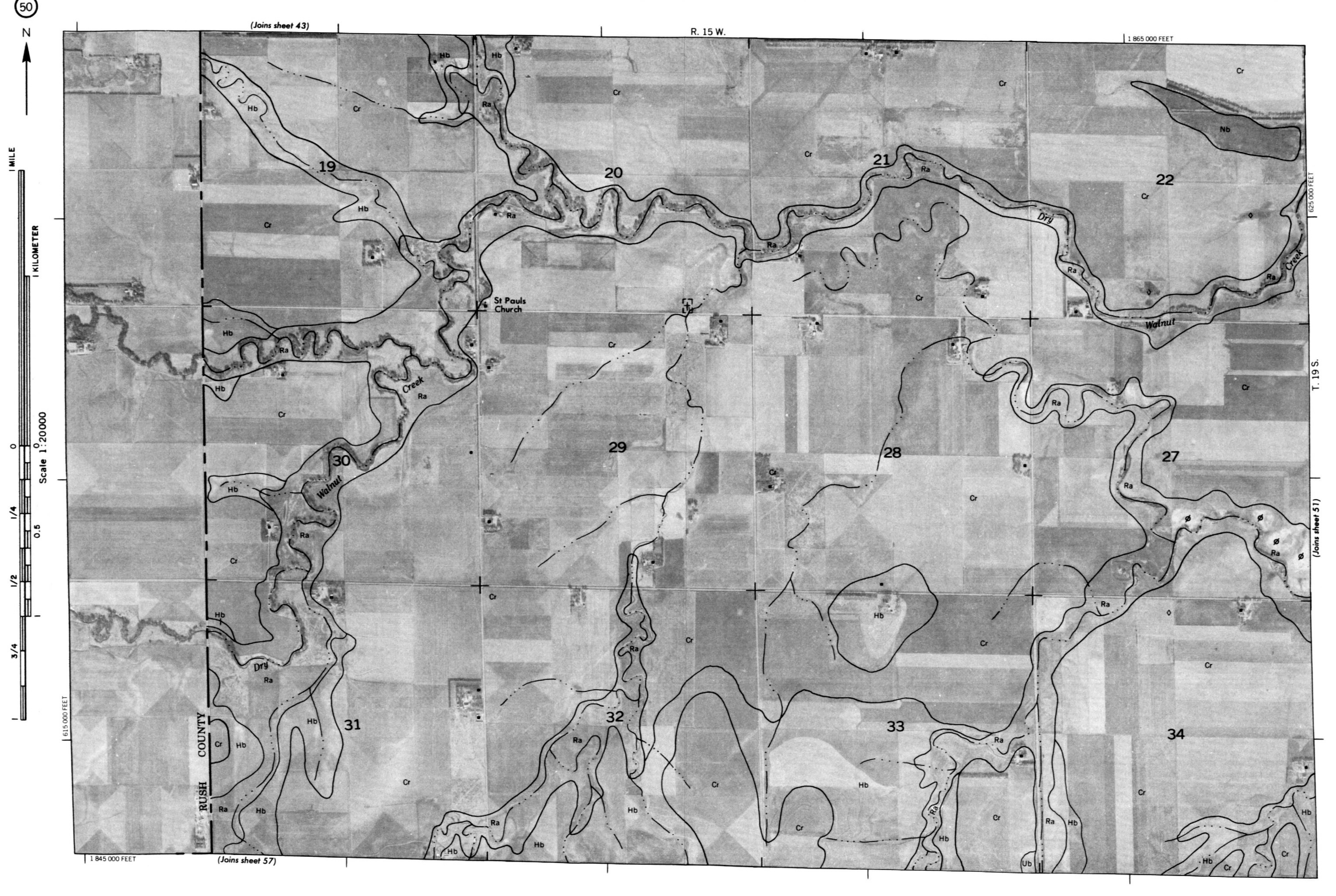

45
N
R. 14 W.
R. 13 W.
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 44)
(Joins sheet 52)
1 895 000 FEET
1 915 000 FEET
640 000 FEET
630 000 FEET
T. 19 S.
Walnut Creek
Cheyenne Bottoms Canal
Cheyenne Bottoms Canal (Underground)
ATCHISON TOPEKA AND SANTA FE
SEWAGE LAGOON
water
96
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 46

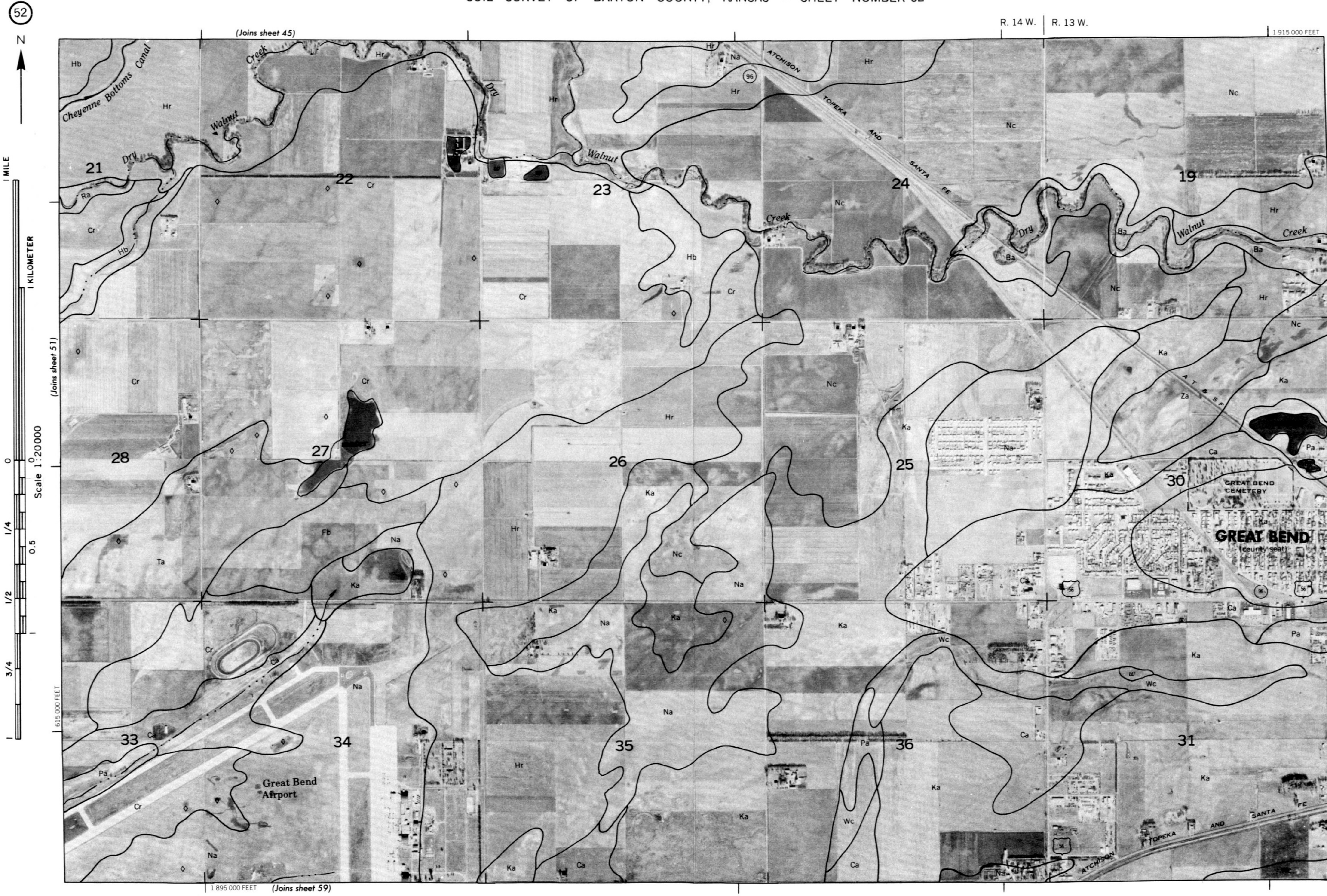

47
N
1 940 000 FEET
R. 13 W.
R. 12 W.
(Joins sheet 40)
(Joins sheet 48)
(Joins sheet 46)
(Joins sheet 54)
1 960 000 FEET
640 000 FEET
630 000 FEET
T. 19 S.
LAND FILL
water
156
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18

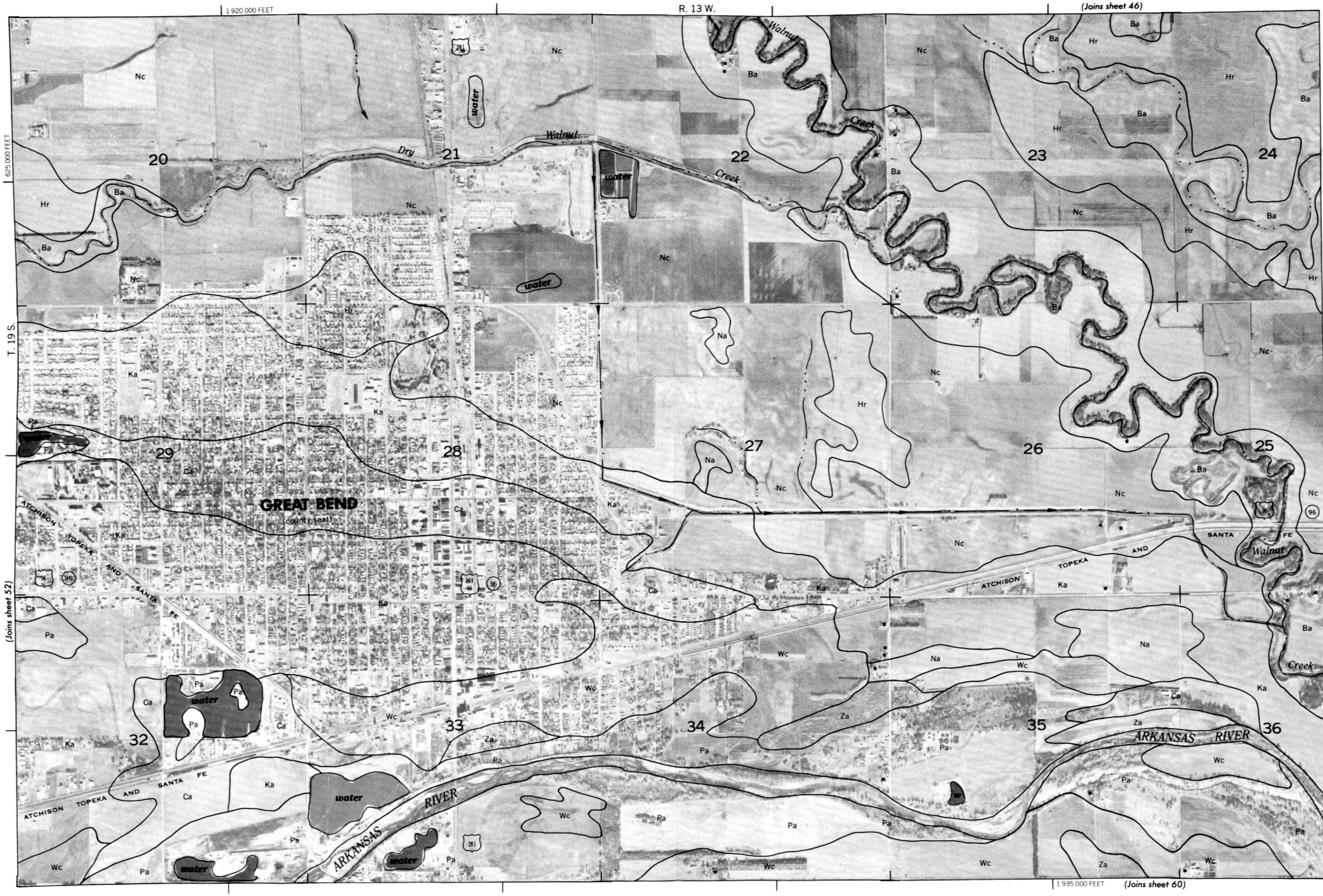

N
(Joins sheet 41)
R. 12 W.
R. 11 W.
1 985 000 FEET
640 000 FEET
T. 19 S.
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 55)
1 965 000 FEET
630 000 FEET
Saints Peter and Paul Church
Little Cheyenne Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


49
N
1 990 000 FEET
R. 11 W.
(Joins sheet 42)
640 000 FEET
T. 19 S.
(Joins sheet 48)
(Joins sheet 56)
2 010 000 FEET
630 000 FEET
RICE COUNTY
Little Cheyenne Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
1
2
3
4
9
10
11
12
13
14
15
16
Ta
Cr
Hb
Fb
Na
Tb
Dw
Cb
Fa
water


50
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 43)
R. 15 W.
1 865 000 FEET
625 000 FEET
T. 19 S.
(Joins sheet 51)
(Joins sheet 57)
1 845 000 FEET
615 000 FEET
RUSH COUNTY
St Pauls Church
Dry Creek
Walnut Creek
19
20
21
22
27
28
29
30
31
32
33
34
Cr
Hb
Ra
Nb
Ub

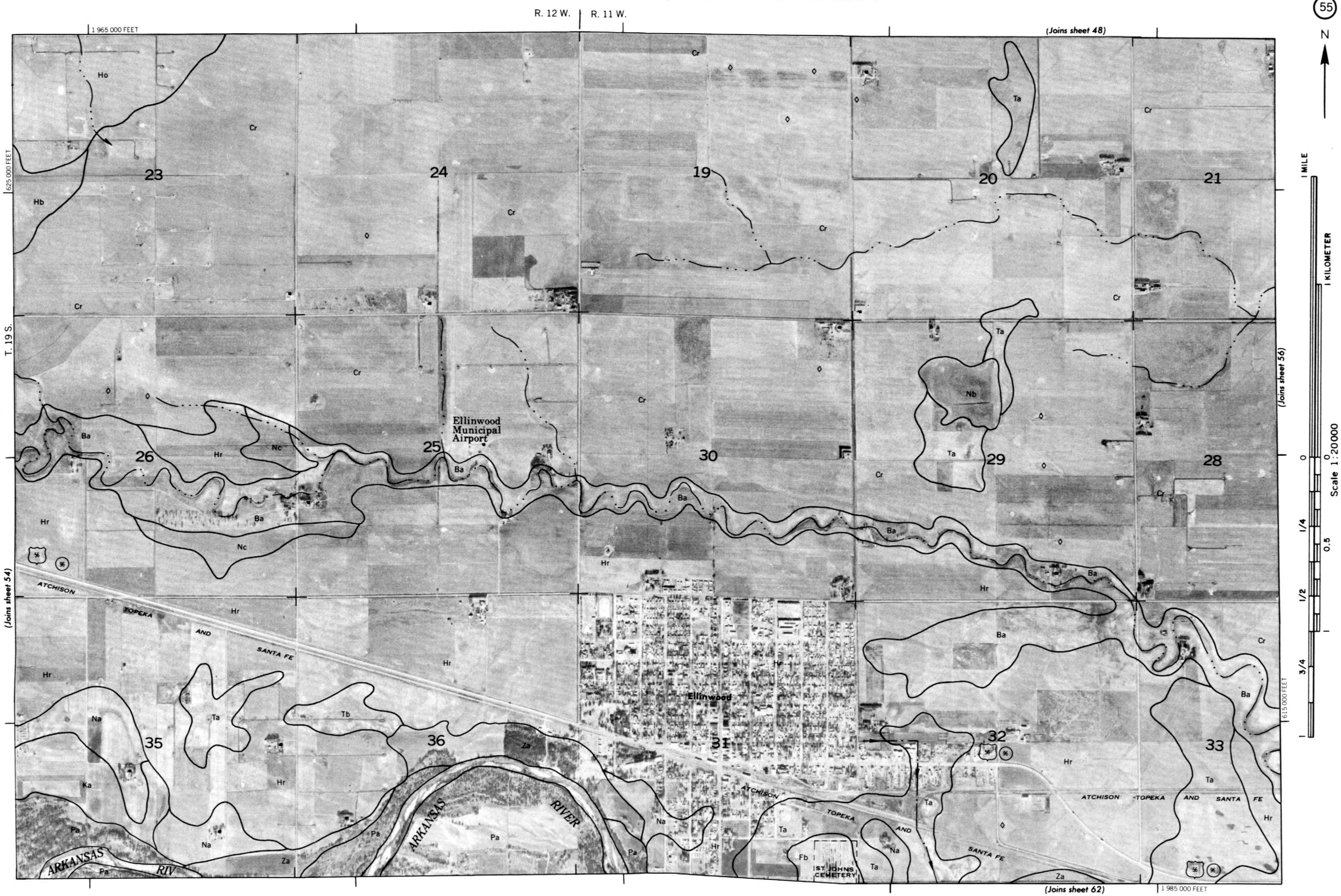

51
N
(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 50)
(Joins sheet 58)
R. 15 W.
R. 14 W.
T. 19 S.
1 870 000 FEET
1 890 000 FEET
625 000 FEET
615 000 FEET
Walnut
Creek
Dry
Cheyenne
Bottoms
Canal
EVERETT CEMETERY
Great Bend Airport
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
Ra
Nb
Cr
Nc
Hb
Hr
Na
Ta
Ca
Pa
w
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


52
N
(Joins sheet 45)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 59)
R. 14 W.
R. 13 W.
T. 19 S.
1 915 000 FEET
625 000 FEET
615 000 FEET
1 895 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
Cheyenne Bottoms Canal
Walnut
Creek
Dry
ATCHISON
TOPEKA
AND
SANTA
FE
A T & S F
GREAT BEND
(county seat)
GREAT BEND CEMETERY
Great Bend Airport
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
Hb
Hr
Ra
Cr
Na
Nc
Ba
Ka
Za
Ca
Pa
Fb
Ta
Wc
w
96
56



1 920 000 FEET
R. 13 W.
(Joins sheet 46)
625 000 FEET
T. 19 S.
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 60)
1 935 000 FEET
615 000 FEET
GREAT BEND
(county seat)
Dry Walnut Creek
Walnut Creek
ARKANSAS RIVER
ATCHISON TOPEKA AND SANTA FE
water
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
Nc
Hr
Ba
Ka
Pa
Ca
Na
Wc
Za
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

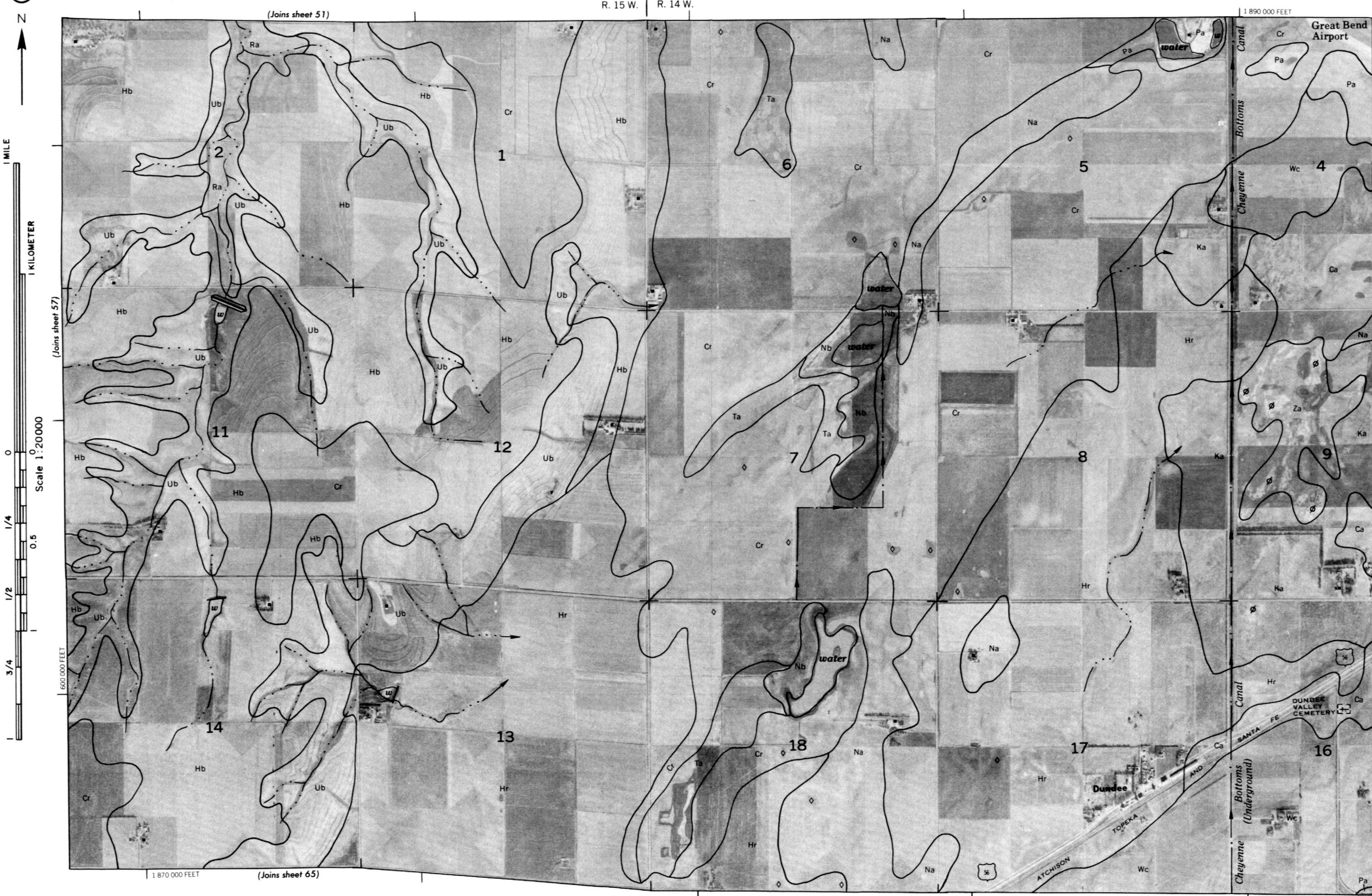
SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 54

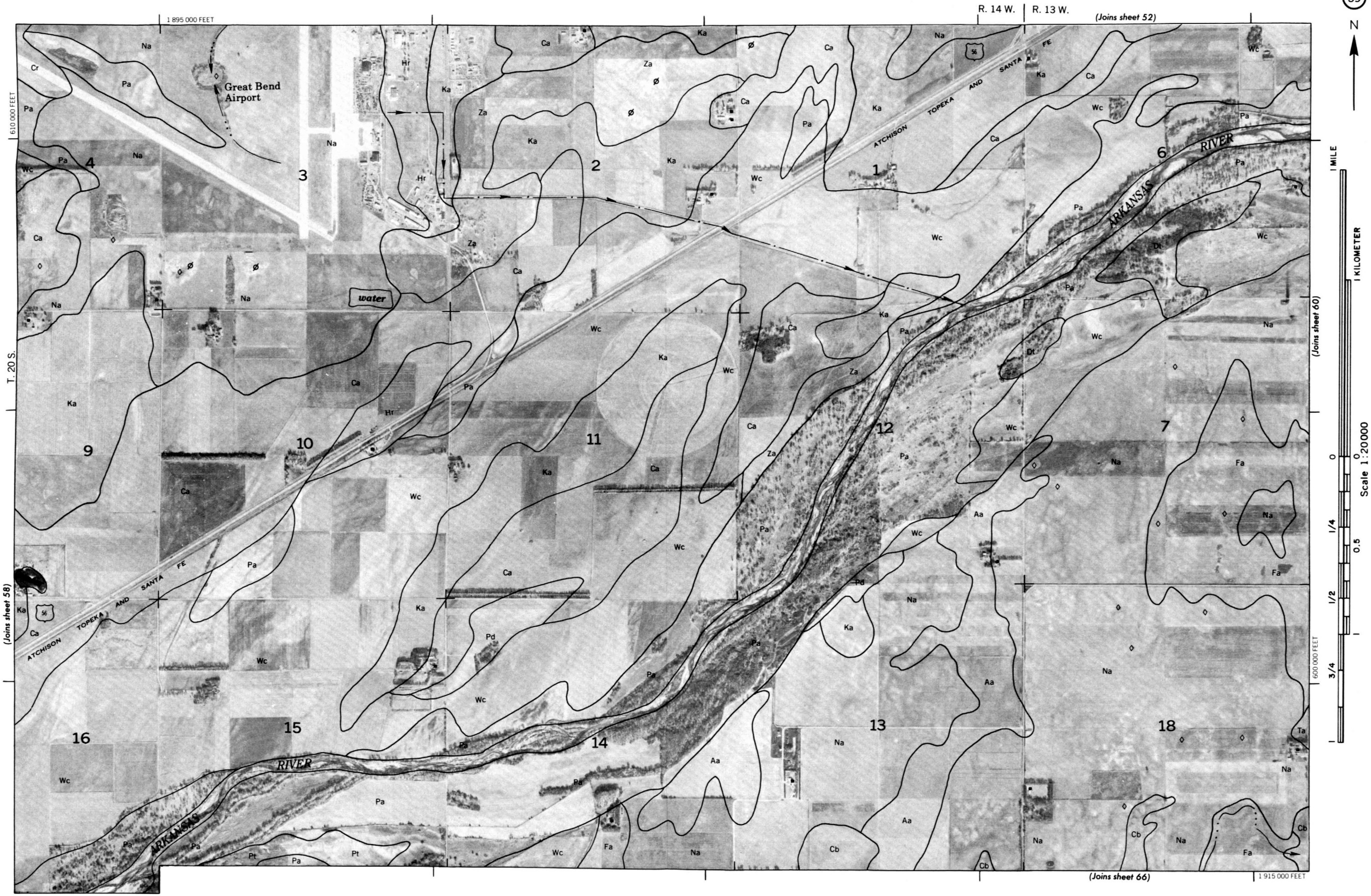

55
R. 12 W.
R. 11 W.
1 965 000 FEET
(Joins sheet 48)
(Joins sheet 56)
(Joins sheet 54)
(Joins sheet 62)
625 000 FEET
615 000 FEET
1 985 000 FEET
T. 19 S.
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
Ellinwood Municipal Airport
Ellinwood
ATCHISON TOPEKA AND SANTA FE
ARKANSAS RIVER
ARKANSAS RIV
ST JOHNS CEMETERY
56
96
Ho
Hb
Cr
Ta
Nb
Ba
Hr
Nc
Na
Ka
Pa
Za
Tb
Fb

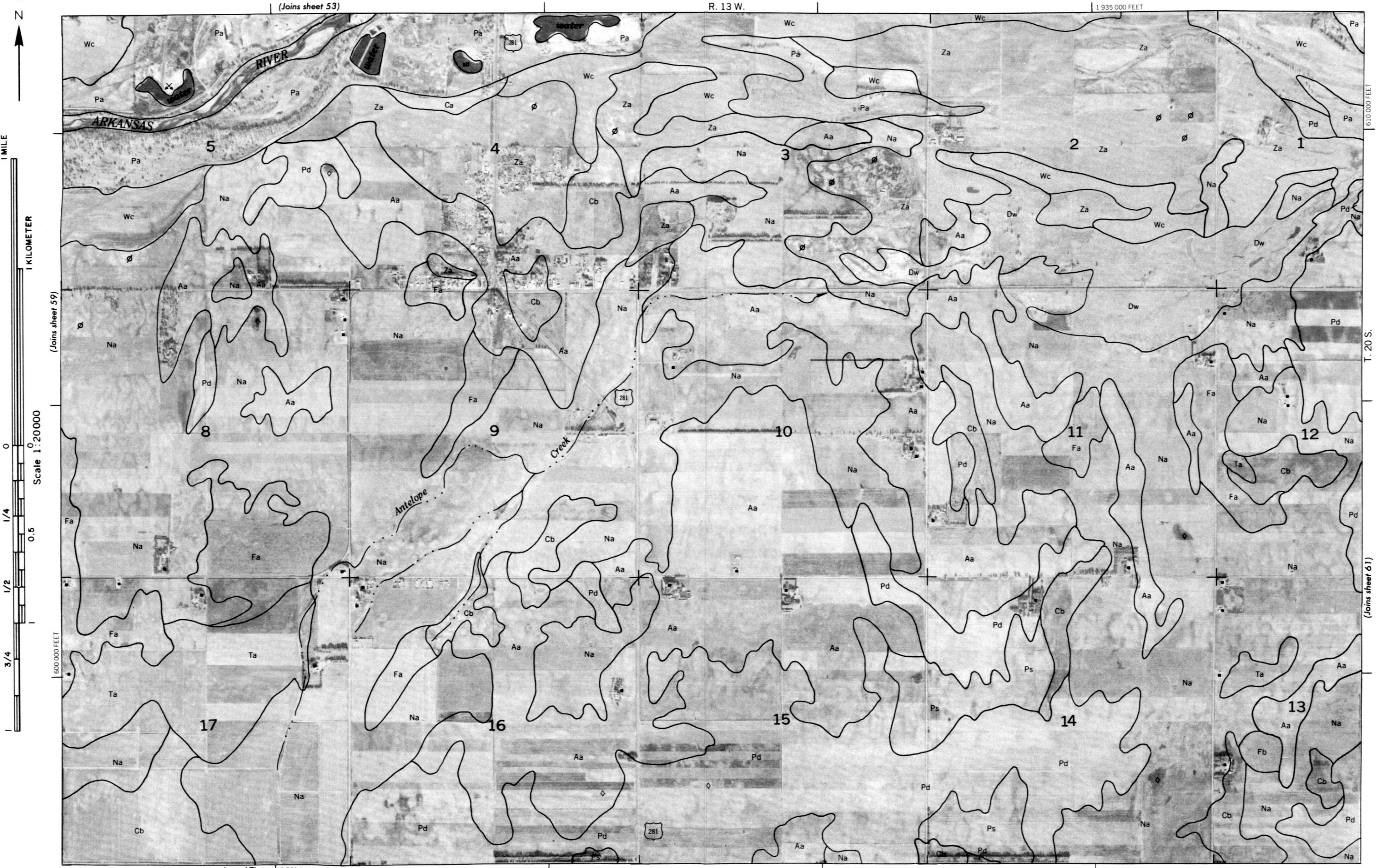
SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 56

57

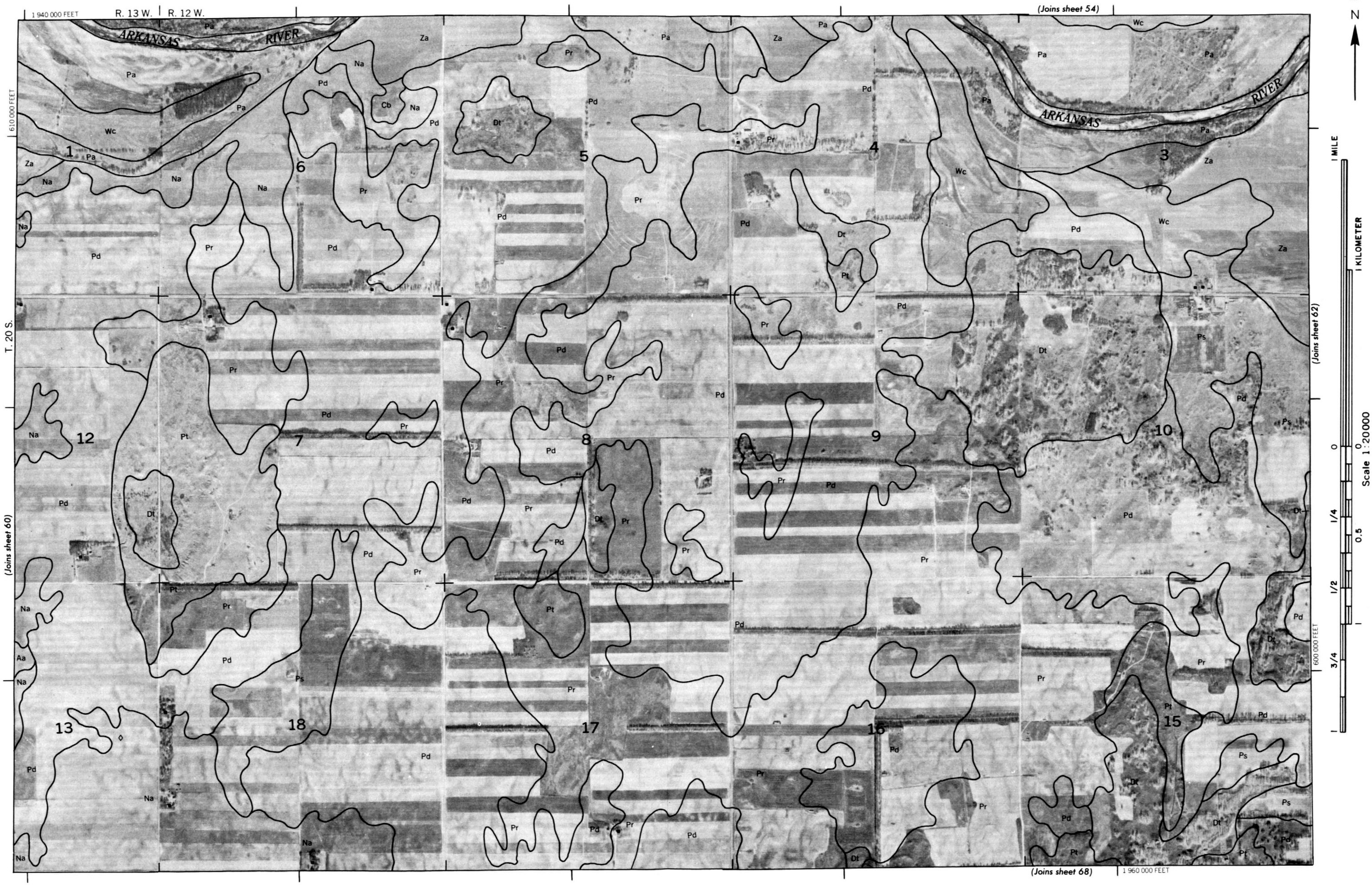

1 845 000 FEET
R. 15 W.
(Joins sheet 50)
N
610 000 FEET
T. 20 S.
PAWNEE COUNTY
(Joins sheet 58)
Bergtal Church
BERGTAL CEMETERY
(Joins sheet 64)
1 865 000 FEET
600 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
3
4
5
6
7
8
9
10
15
16
17
18


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
R. 15 W.
R. 14 W.
T. 20 S.
(Joins sheet 51)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 65)
1 890 000 FEET
610 000 FEET
600 000 FEET
1 870 000 FEET
Great Bend Airport
Cheyenne Bottoms Canal
Cheyenne Bottoms (Underground) Canal
DUNDEE VALLEY CEMETERY
Dundee
ATCHISON TOPEKA AND SANTA FE
56
water
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
Hb
Ub
Ra
Cr
Na
Nb
Ta
Pa
Wc
Ka
Ca
Hr
Za


59
N
R. 14 W.
R. 13 W.
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 66)
(Joins sheet 58)
1 895 000 FEET
1 915 000 FEET
610 000 FEET
600 000 FEET
T. 20 S.
Great Bend Airport
water
ATCHISON TOPEKA AND SANTA FE
ARKANSAS RIVER
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

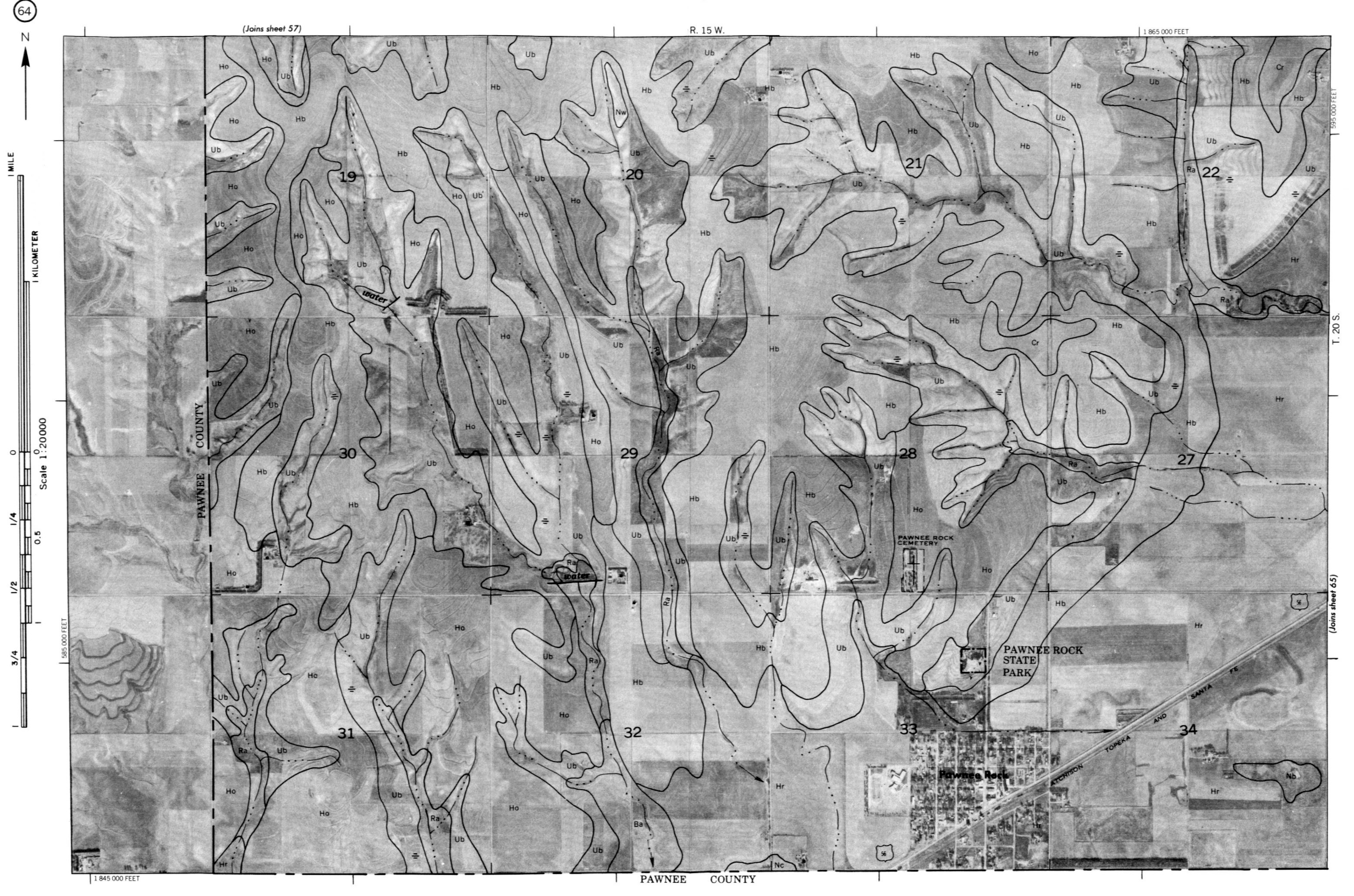

N
(Joins sheet 53)
R. 13 W.
1 935 000 FEET
610 000 FEET
T. 20 S.
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 67)
1 920 000 FEET
600 000 FEET
ARKANSAS
RIVER
Antelope
Creek
water
281
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
5
4
3
2
1
8
9
10
11
12
17
16
15
14
13

SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 61



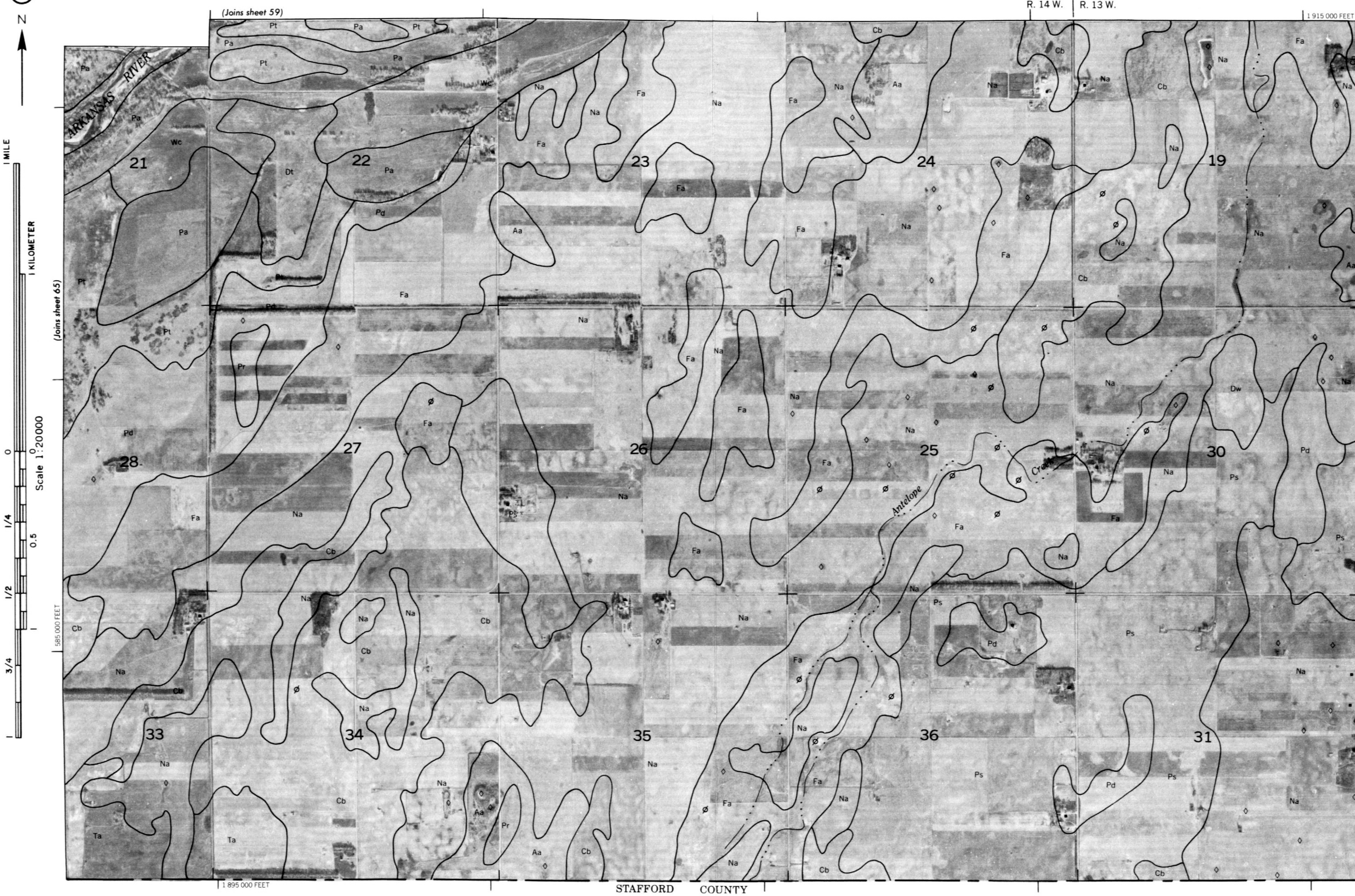
SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 62

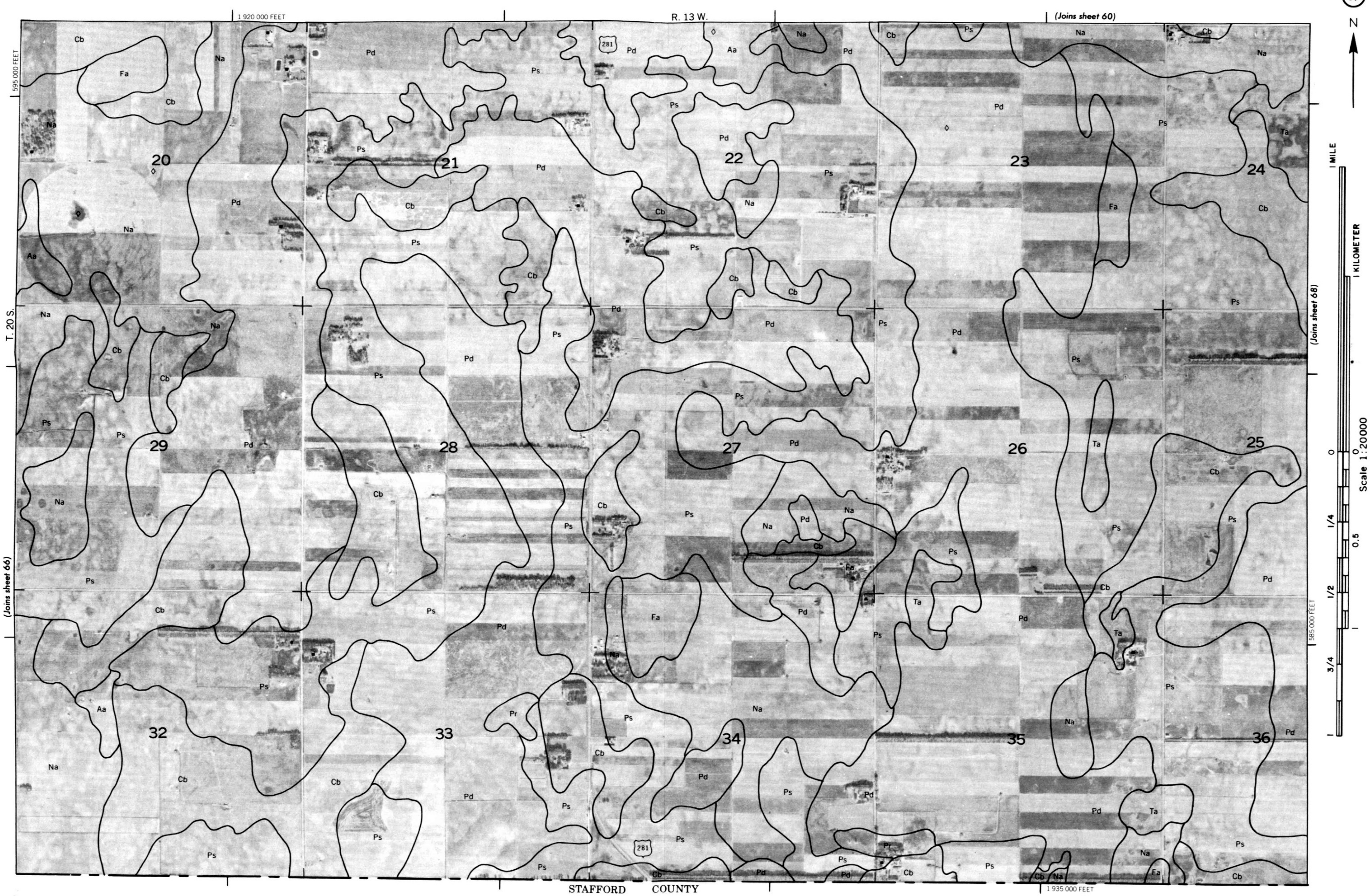

63
N
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 70)
1 990 000 FEET
2 010 000 FEET
610 000 FEET
600 000 FEET
R. 11 W.
T. 20 S.
RICE COUNTY
ARKANSAS RIVER
ATCHISON TOPEKA AND SANTA FE
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5
1
1
2
3
4
9
10
11
12
13
14
15
16

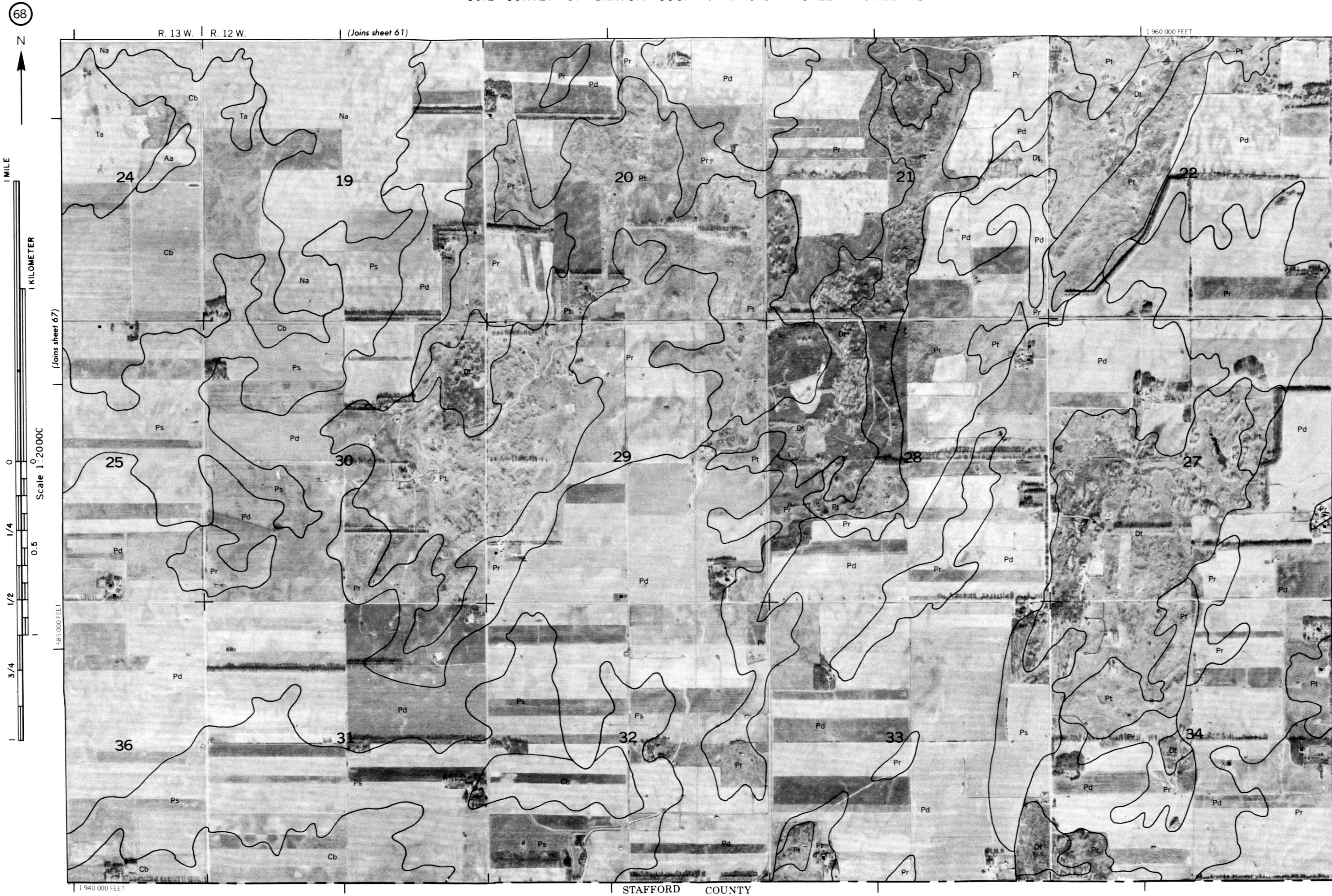

64
N
(Joins sheet 57)
R. 15 W.
1 865 000 FEET
595 000 FEET
T. 20 S.
(Joins sheet 65)
585 000 FEET
1 845 000 FEET
PAWNEE COUNTY
PAWNEE COUNTY
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
19
20
21
22
30
29
28
27
31
32
33
34
PAWNEE ROCK CEMETERY
PAWNEE ROCK STATE PARK
Pawnee Rock
ATCHISON TOPEKA AND SANTA FE
56
water
Ho
Hb
Ub
Nw
Ra
Cr
Hr
Ba
Nc
Nb


65
N
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 66)
R. 15 W.
R. 14 W.
T. 20 S.
1 870 000 FEET
595 000 FEET
585 000 FEET
1 890 000 FEET
ATCHISON TOPEKA AND SANTA FE
Cheyenne Bottoms Canal
(Underground)
ARKANSAS RIVER
PAWNEE COUNTY
STAFFORD COUNTY
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1

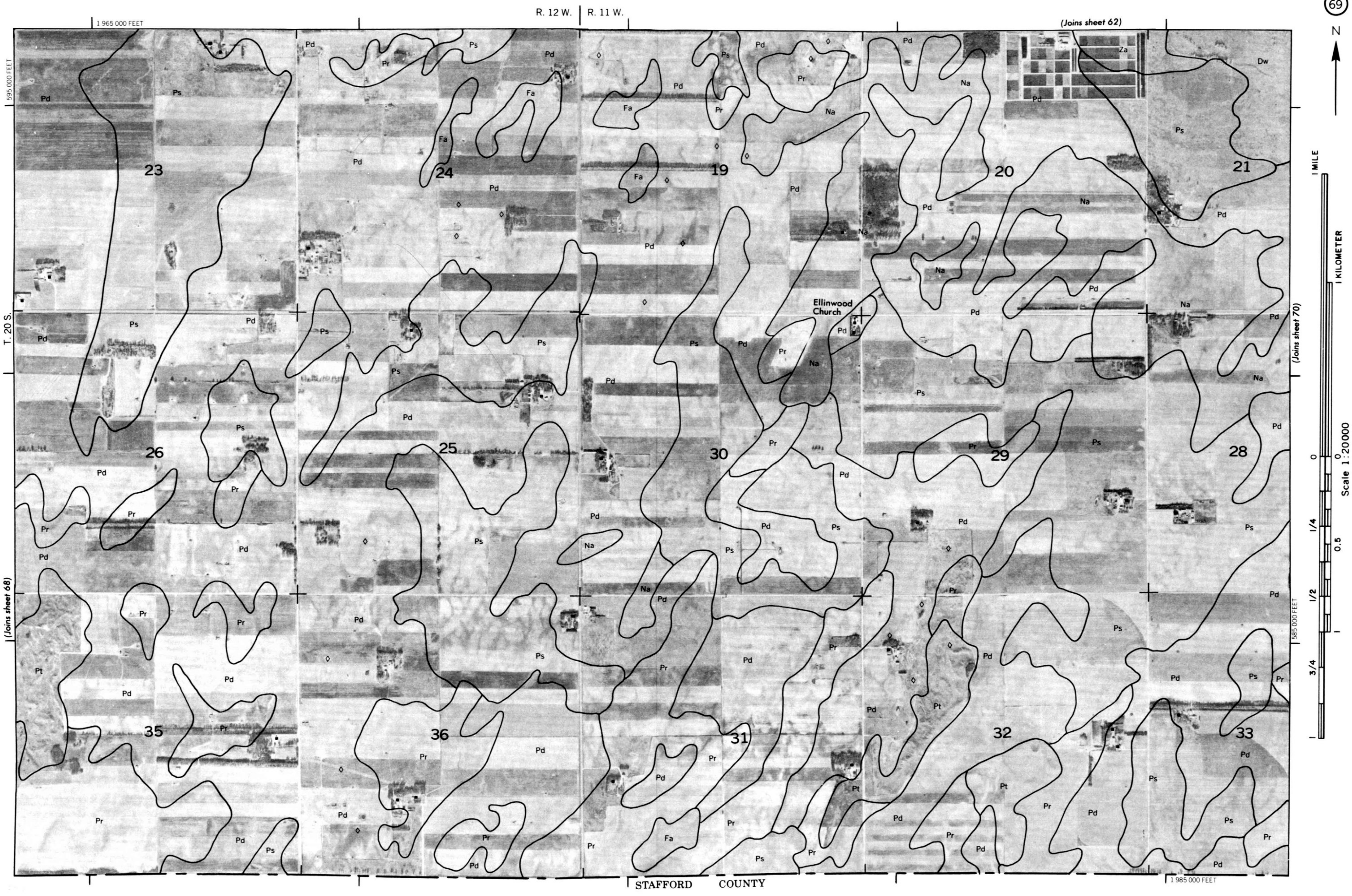
SOIL SURVEY OF BARTON COUNTY, KANSAS – SHEET NUMBER 66

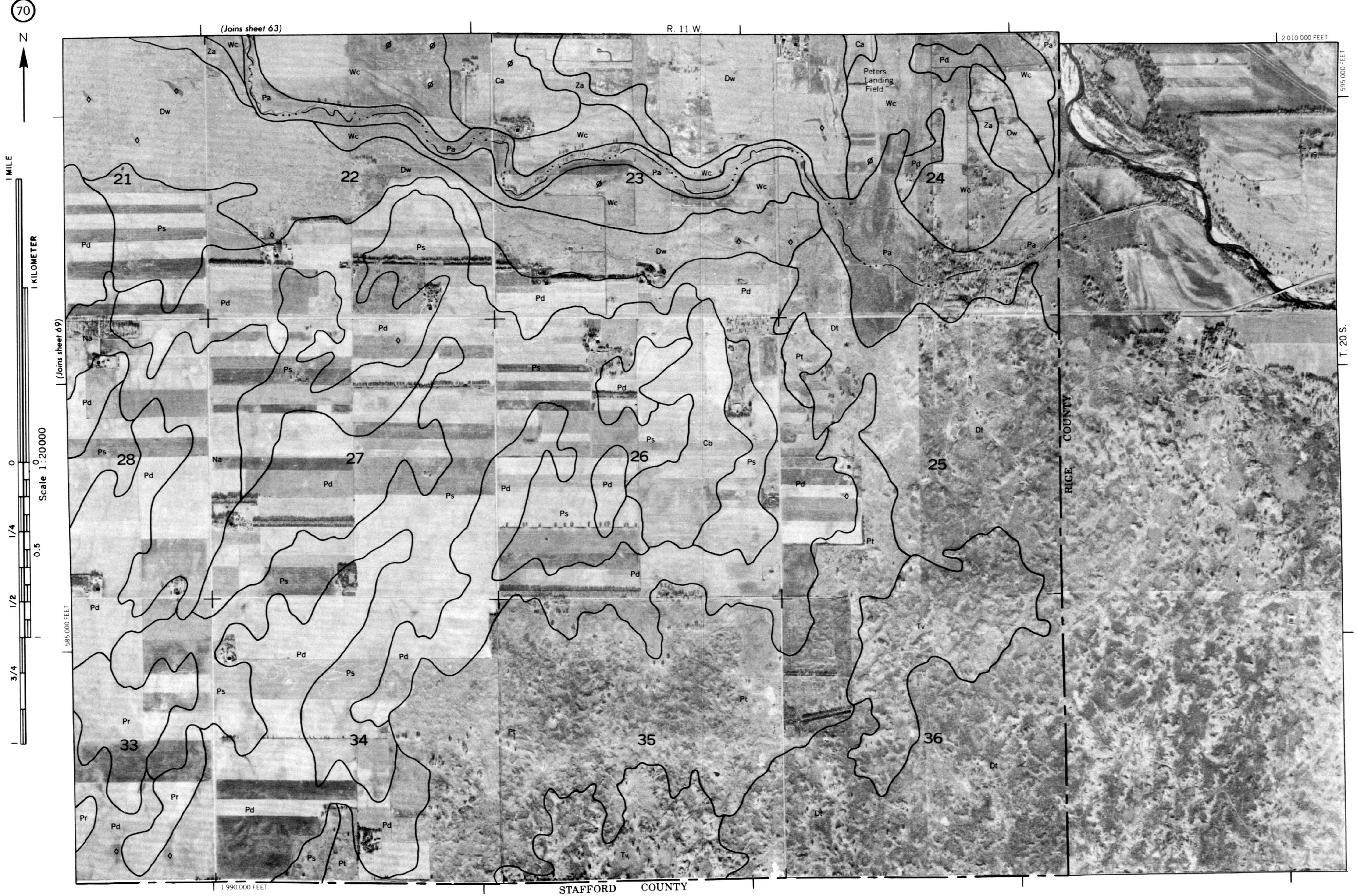



67
N
1 920 000 FEET
R. 13 W.
(Joins sheet 60)
595 000 FEET
T. 20 S.
(Joins sheet 66)
(Joins sheet 68)
585 000 FEET
1 935 000 FEET
STAFFORD COUNTY
281
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
Aa
Cb
Fa
Na
Pd
Pr
Ps
Ta
Ea
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


68
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
R. 13 W.
R. 12 W.
(Joins sheet 61)
1 960 000 FEET
595 000 FEET
T. 20 S.
(Joins sheet 67)
(Joins sheet 69)
585 000 FEET
1 940 000 FEET
STAFFORD COUNTY
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
Na
Cb
Ta
Aa
Pd
Pr
Pt
Ps
Dt

SOIL SURVEY OF BARTON COUNTY, KANSAS - SHEET NUMBER 69




70
N
(Joins sheet 63)
R. 11 W.
2 010 000 FEET
595 000 FEET
(Joins sheet 69)
T. 20 S.
585 000 FEET
1 990 000 FEET
RICE COUNTY
STAFFORD COUNTY
Peters Landing Field
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
0.5
1/2
3/4
1
21
22
23
24
25
26
27
28
33
34
35
36
Za
Wc
Dw
Pa
Ca
Ps
Pd
Na
Dt
Pt
Cb
Pr
Tv